the OIL AND GAS JOURNAL

OCTOBER 8, 1956

Annual Drilling Number

FEATURING

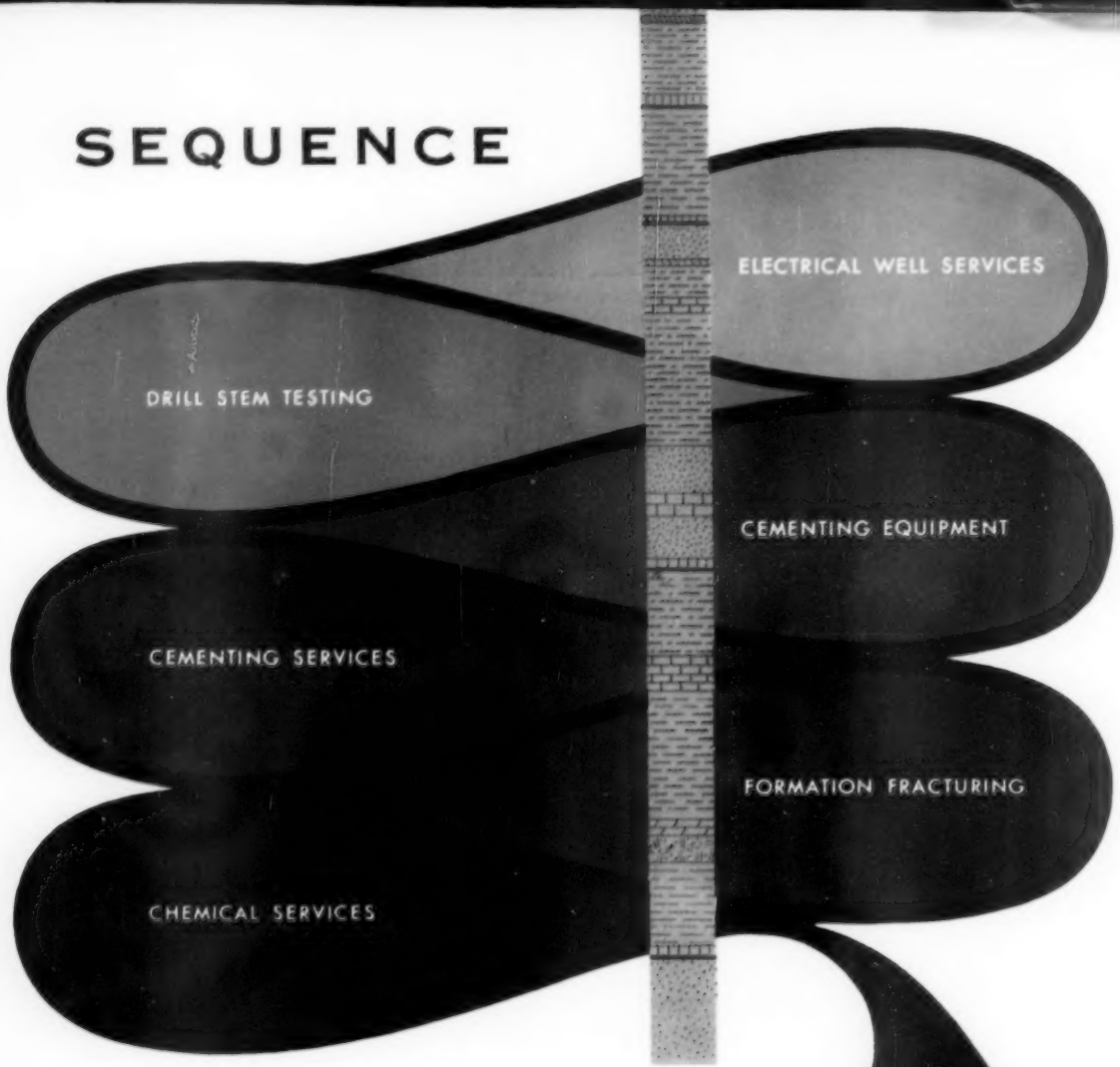
- DRILL STRING
- DRILLING LINE

Also—

What the Highway Program Means to Asphalt Producers p. 110

Kermac Unveils Radical New Design in Offshore Platforms p. 118

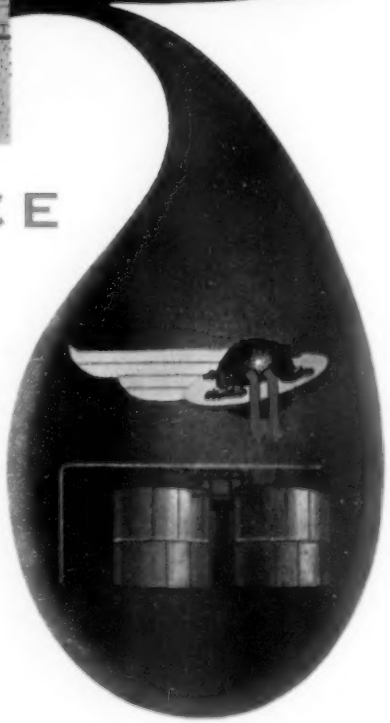
SEQUENCE



CONSEQUENCE

Out of the pipe comes the final answer . . . right or wrong. You've done your best to recover the maximum potential. You've brought into common action all the well completion services and production improvement techniques at your command. Your chances that the answer will lie on the right side of the balance sheet will be greatly improved if it's the *Halliburton sequence* of services you've used. A uniform, logical succession of interdependent techniques that let your well say which . . . because there is no selfish emphasis on one service at the expense of others.

Each of these six services is backed by Halliburton's three-million-job experience . . . 33 years of research . . . and unique policy of performing service beyond the fee, service above all. And each makes an important contribution to putting more oil in your tanks . . . the most desirable possible consequence.



"Progress In Service Through Research"

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OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

An option to purchase Dotson & Drosdat Drilling Co., Venezuelan drilling contractor, has been taken by an American contractor interested in entering the foreign field. D. & D. owns six rigs and operates three or four others under labor contracts. The company is headquartered at Anaco, Eastern Venezuela.

Automatic custody transfer is moving out of the testing stage. Phillips Petroleum Co. will install an estimated 25 batteries in 1957 to replace hand-gaging of oil at the lease. Phillips, at least for the present, is sticking with the Weir system of controlling volume with calibrated measuring vessels.

The company proved the system with its North Burbank unit, which is already selling oil and destined to become a show-case operation. Two other Phillips batteries are in the building stage. One is competing with a Shell Oil Co. positive-displacement metering system as Texas' first automatic transfer system.

The Russian turbodrills imported by Dresser Industries will get their first workout in West Texas or the Illinois basin. These tests will answer a lot of questions about the claims of exceptionally fast penetration rates made by the Russians. Despite the wait-and-see attitude adopted by much of the industry, Dresser is being flooded with inquiries about the drill.

Because of their high cost, the turbodrills will probably be made available on a lease basis when they are ready for field use. Security Engineering Division is expected to get the job of manufacturing Dresser's own turbodrill, incorporating some features of the Russian and French tools.

The industry will soon know more about the Cuban oil field opened by Cuban American's 1 Catalina 4½ miles southwest of Jatibonico field in August. Cuban Canadian, subsidiary of American Leduc Petroleums, last week was testing shows at 9,000 ft. in a confirmation well half a mile north of 1 Catalina. The Cuban American strike is the first on the island to produce high-gravity oil from any substantial depth.

Military requirements for major products will continue to keep pace with consumer demand. Defense Department purchases last year figured out at close to 5 per cent of total production. They will hold at that rate for another year at least. Jet fuel needs are increasing, but there is no drop in purchases of aviation gasoline.

A 1,000-man executive reserve will be recruited by Interior's oil and gas office to man the next war's successor to the Petroleum Administration for Defense.

Most of the men asked to serve in an emergency will be from the group that worked in PAD. Interior now has a basic blueprint for wartime oil and gas regulation. It could be called into use short of war—if both the Suez Canal and the Middle East pipelines were closed.

Alkylation is going to see a big play, for three reasons: 1.—More motor alkylate will be used as the octane trend continues; 2.—commercial avgas consumption is not going to decline for several years, contrary to past estimates, and 3.—the remaining avgas demand for the indefinite future will consist of a growing percentage of the 115/145 grade which requires more alkylate than others.

The OIL AND GAS JOURNAL

OCTOBER 8, 1956 • VOLUME 54 • NUMBER 75

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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ANNUAL DRILLING NUMBER

How to Get Your Money's Worth From Your Drill String **133**

By Ed McGhee

A special 21-page report on this important subject, compiled by the Journal's Houston drilling and production editor. A handbook designed for use on the rig—to save you money.

How to Get Your Money's Worth From Your Wire Line **149**

By J. O. Scott

A special 16-page report compiled by the Journal's Tulsa drilling and production editor. A handbook designed for day-to-day rig operation, which shows how costs can be reduced while maintaining strong, safe lines.

Training the Drilling Crews **170**

Great Western Drilling Co. is putting its men through a training school and following it up with pay raises and other incentives to remain on the job.

Record-Breaking Rig Has New Look **177**

Ohio Oil Co.'s record-breaking rig (California 1953) has had its face lifted and is now ready for work in southern Oklahoma's deeper drilling.

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By D. H. Stormont

This chart shows mud data from a given well in readily usable form, for use in drilling nearby wells.

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By W. T. Smith

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By P. P. Scott, Jr., and J. L. Lummus

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By Donald G. Quinn

Here's a check list which greatly simplifies the operation of operating the full-view mast.

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By Norman S. Morrisey

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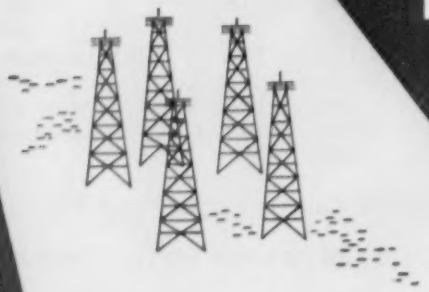
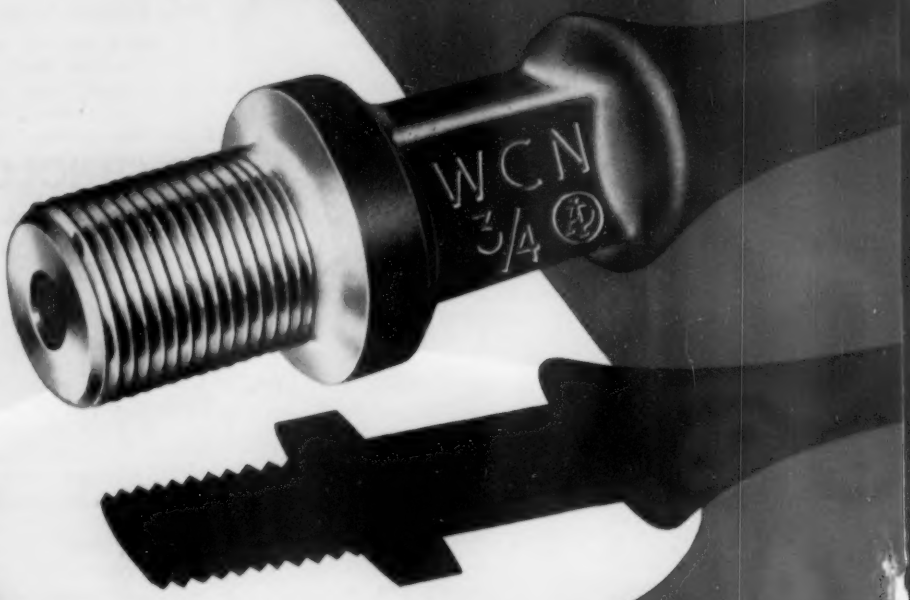
Finest

IN THE FIELD





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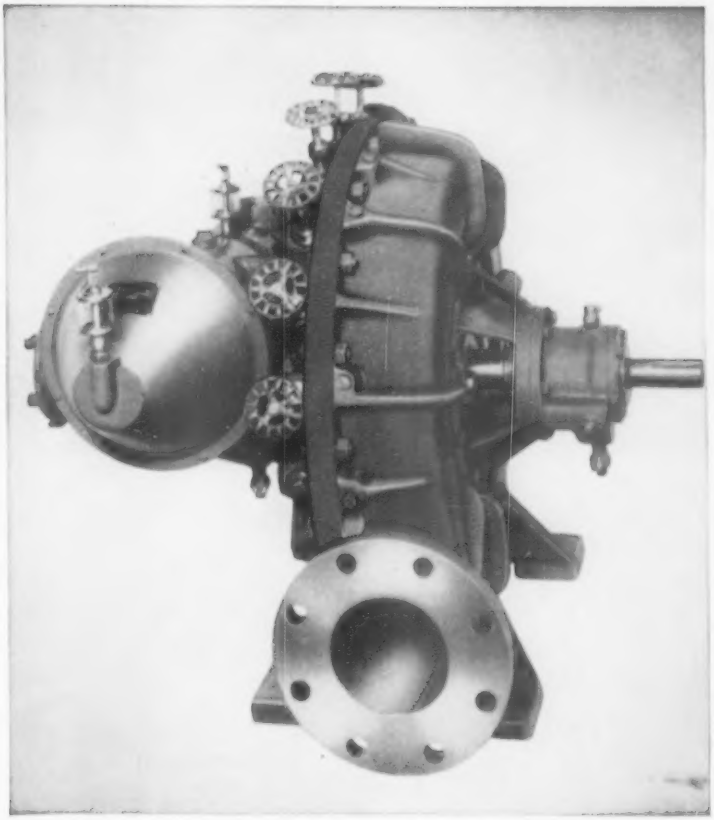
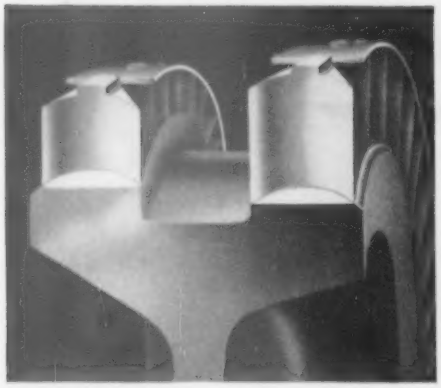
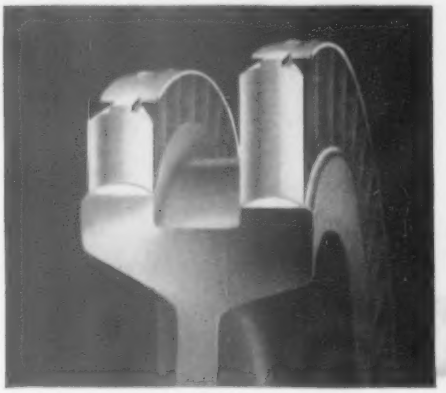


This is the reliable Coppus Turbine furnished with either type of wheel



Wide bucket "L" type wheel



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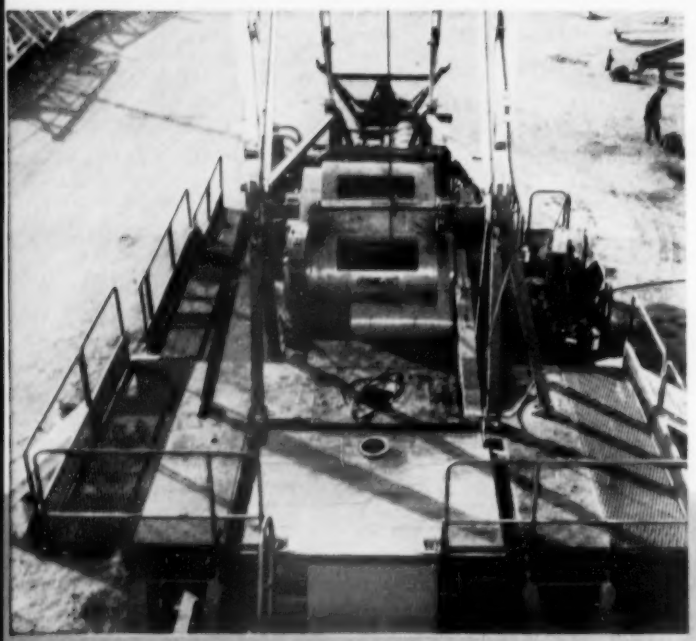
"Oilwell" 52-T Trailer Mounted Rig For 6,000 ft. Drilling



SEE how the rotary table, draw works, engine and drive are all a permanent part of the trailer bed . . . and how the low engine mount permits the 97-ft. Lee C. Moore cantilever mast with retractable top to be transported in horizontal position. The entire unit rolls on a single trailer.

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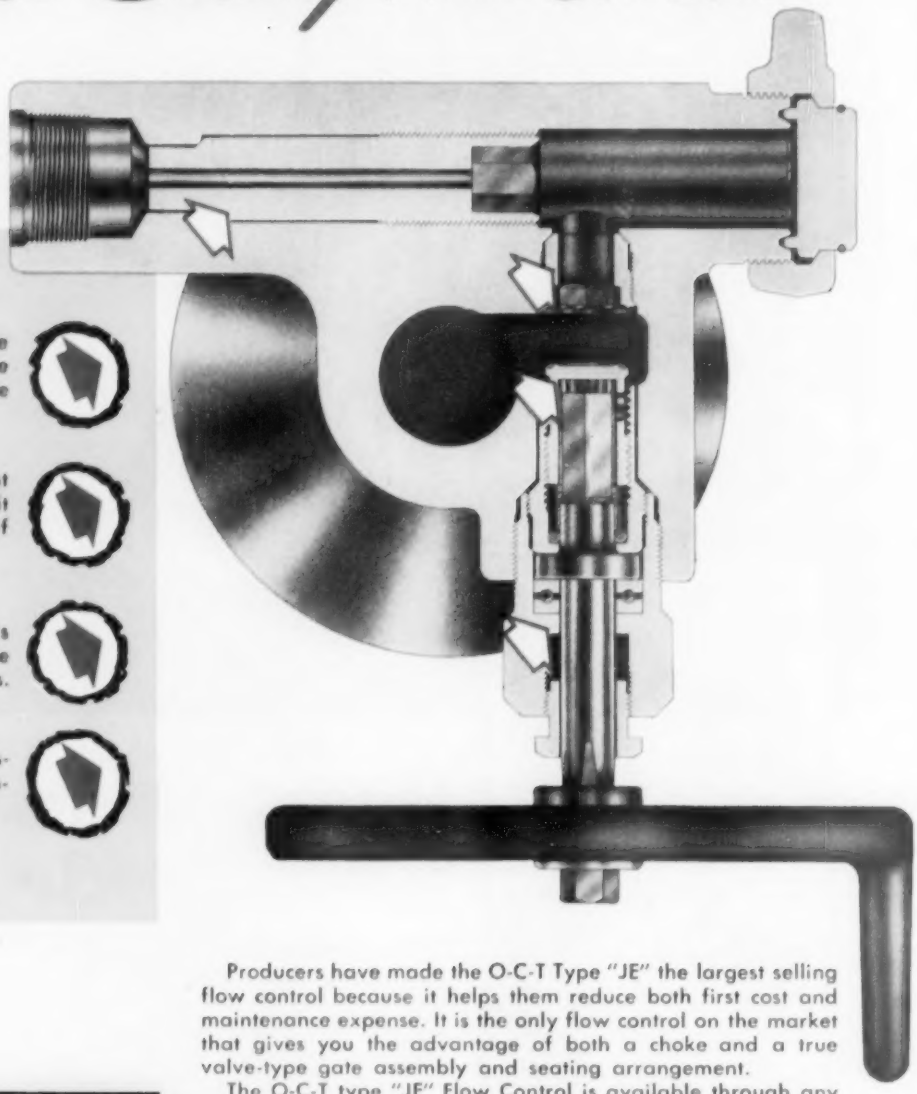

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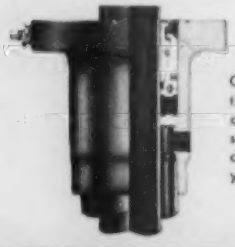

The O-C-T C-19 Casing head can support the longest strings with complete safety. It is the safest, most economical deep well casing head you can buy.

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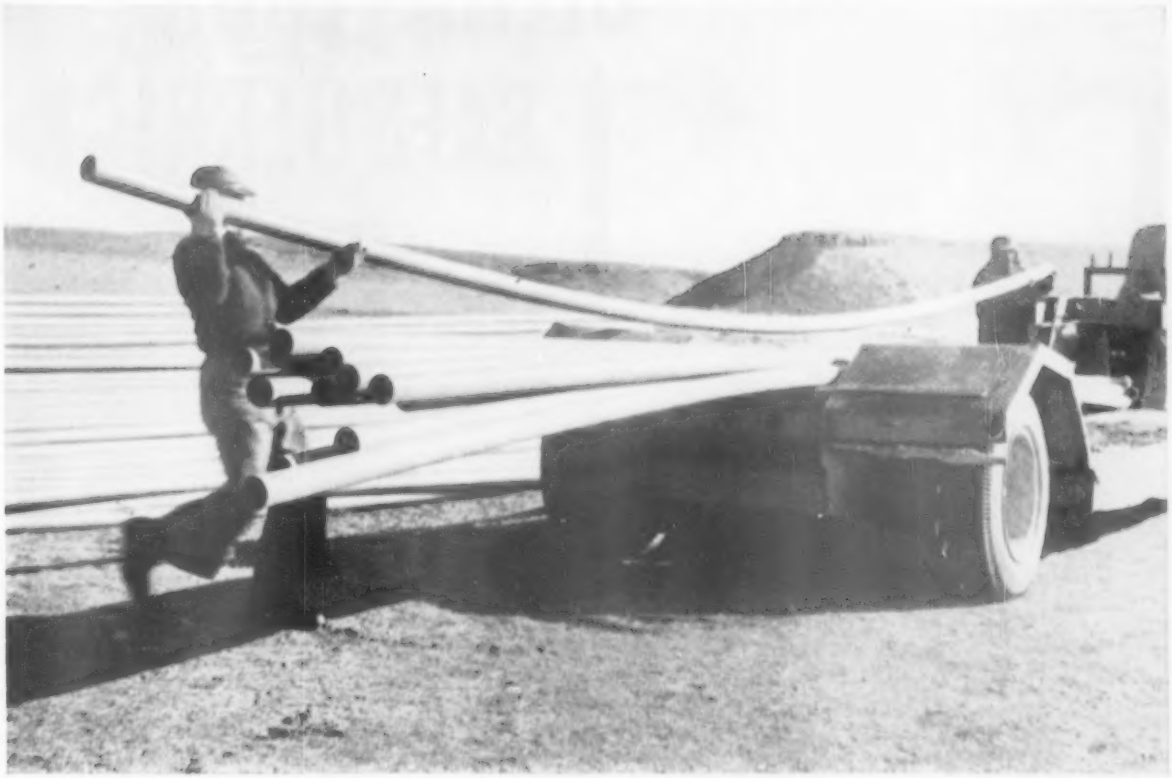

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Now it's easy to stop piping corrosion

Fast Assembly . . . *Pipe is joined with fittings and solvent cement. A sound joint can be made in less than a minute.*

. . . install Geon rigid vinyl

YOU can now obtain rigid vinyl pipe and fittings made of Geon polyvinyl materials from leading manufacturers. This remarkable plastic is immune to galvanic corrosion, eliminating the major source of failure of underground lines. It is highly resistant to salt water and sour crude oil, as well as to most corrosive chemicals.

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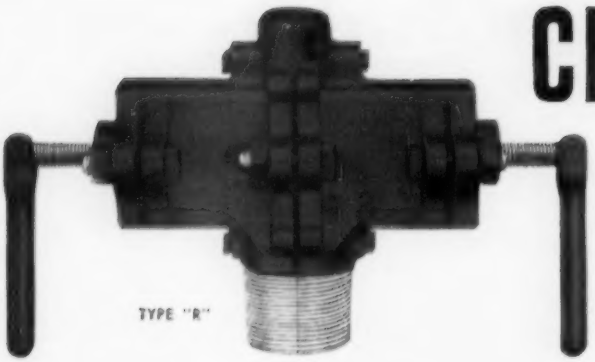

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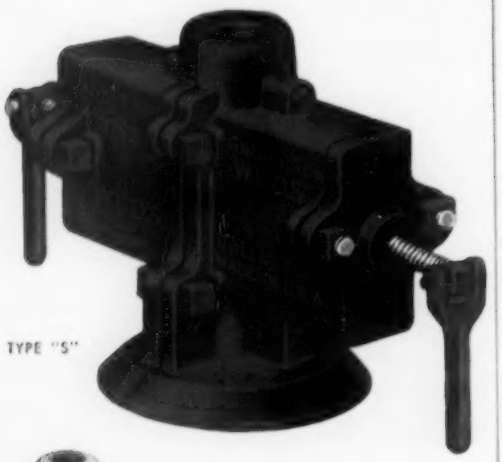

TYPE "S"

TYPE "D"

TYPE "B" RELEASING ATTACHMENT

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SICROMO-7

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23 TIMKEN® STEELS FOR HIGH TEMPERATURE SERVICE

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Carbon-Mo.	Sicromo 2½	Sicromo 5MS	25-20
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-12
Silmo	Sicromo 5	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti	18-8 Cb	

**Not available as seamless tubing at the present time.*

General view of the Timken Company metallographic laboratory where many analyses of steels are viewed under high-power microscopes.

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SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

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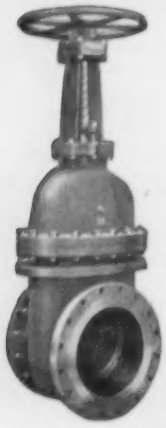

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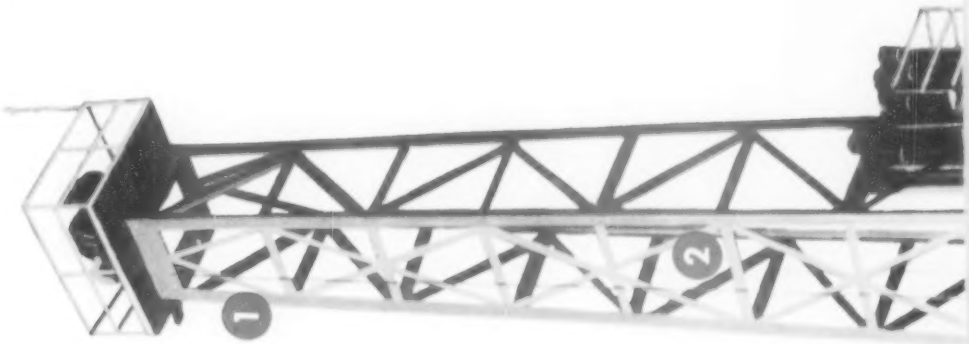

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. . . and EVERYTHING else in equipment, accessories and supplies needed to drill an oil or gas well!

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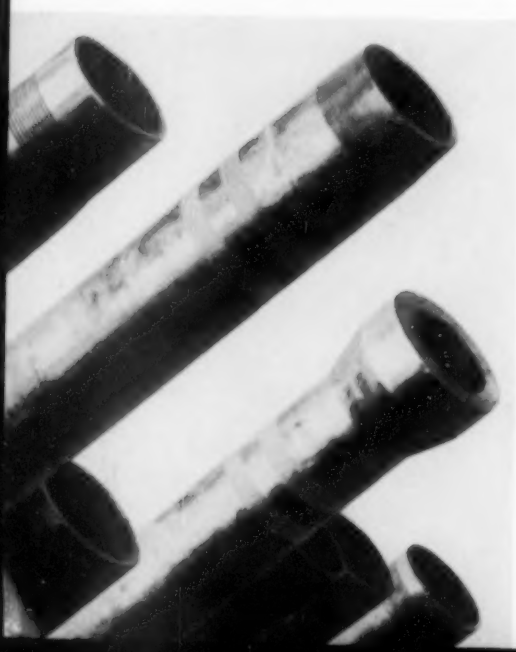

...for *all*
Drilling
Rigs

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For Every

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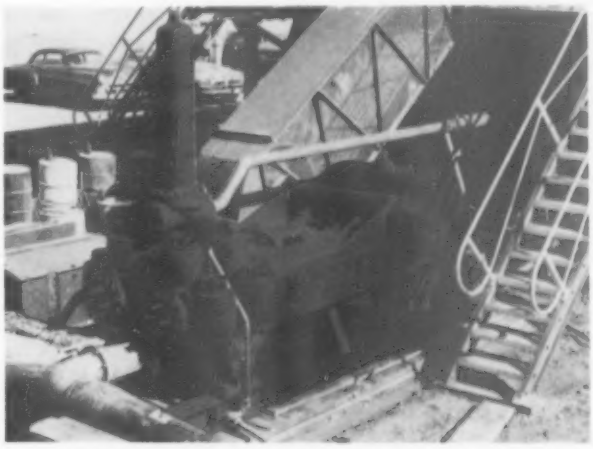
for Every Job including the
rength, High Performance

GARDNER-DENVER
POWER MUD PUMPS

A Size for Every Application



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very Drilling need
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TEST SPECIAL V-BELTS

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...and all other
Rubber Products
for Rig Operation

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DABLE *SERVICE*

Every Drilling Industry man knows the importance of having quality equipment and supplies making up a rig.

These men also recognize that maximum profits come from maximum operating efficiency. Ready availability of needed replacements and supplies contributes to economical operation.

Through its many conveniently located, well-stocked stores, Continental offers quality products, readily available. That's an unbeatable service!

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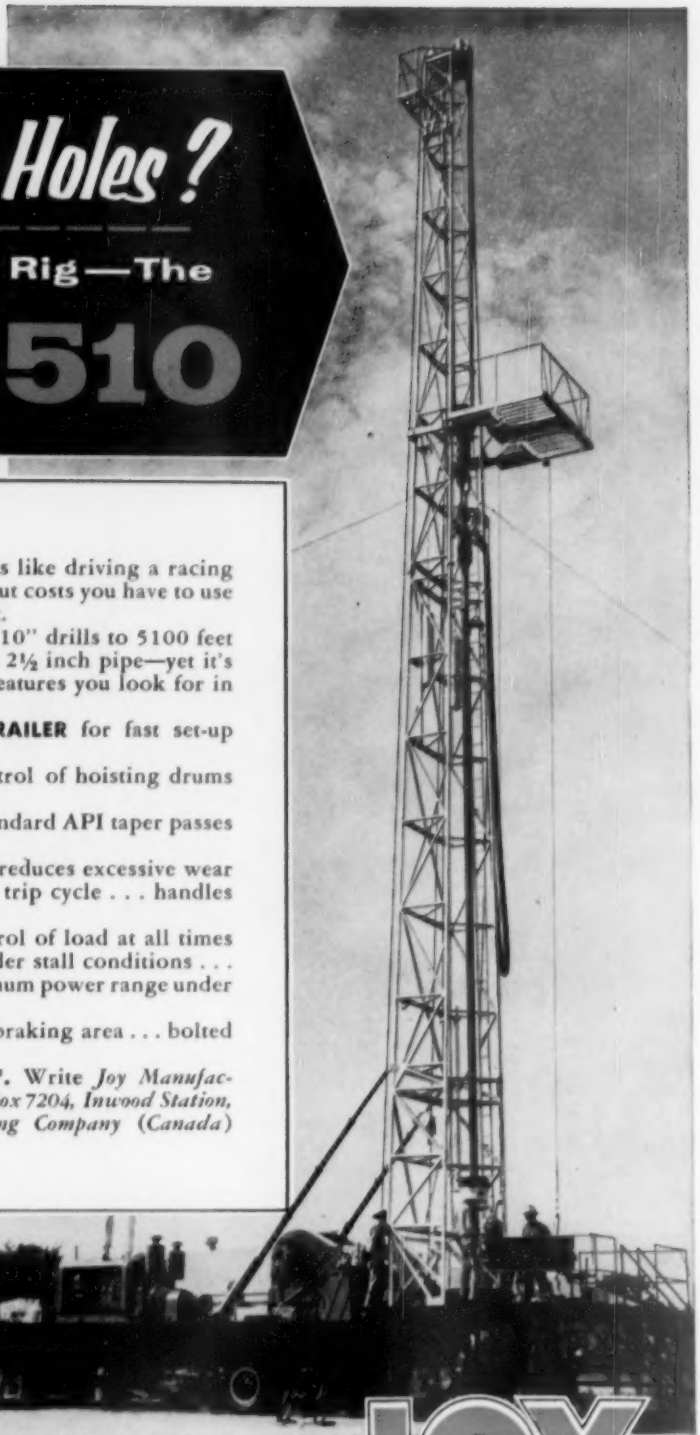
Drilling Slim Holes?

Use a Slim Hole Rig—The JOY 510



Drilling Contractors:

Drilling slim holes with a conventional rig is like driving a racing car at tractor speeds—it's wasteful. To really cut costs you have to use a rig specifically designed for slim hole work.

Here's that rig—the Joy "510." The Joy "510" drills to 5100 feet with 3½ inch drill pipe . . . 10,000 feet with 2½ inch pipe—yet it's completely portable. The "510" has *all* the features you look for in a rig:

ENTIRE DRILL UNIT MOUNTED ON ONE TRAILER for fast set-up and tear-down

AIR-OPERATED CLUTCHES for sensitive control of hoisting drums and rotary drive.

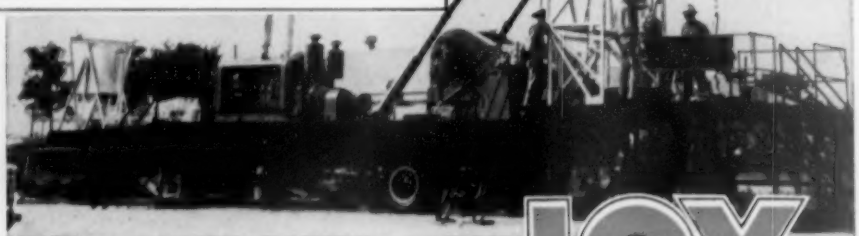
LARGER ROTARY TABLE OPENING with standard API taper passes large diameter bits and casing.

HYDROMATIC BRAKE ON HOISTING DRUM reduces excessive wear on brake linings and flanges throughout trip cycle . . . handles heavy loads . . . safer.

TORQUE CONVERTER insures complete control of load at all times . . . three times normal engine torque under stall conditions . . . permits engine to operate within its maximum power range under a wide variety of loads.

ALLOY STEEL BRAKE FLANGES have larger braking area . . . bolted to drum for easy replacement.

GET COMPLETE SPECS ON THE JOY "510". Write *Joy Manufacturing Company, Oil Field Drill Division, P.O. Box 7204, Inwood Station, Dallas, Texas.* In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



Write for FREE Bulletin 128-31

Consult a Joy Engineer

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the CLARK *TransVerter*

COMPACT UNIT "PACKAGE" OF

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Trucks Operating on delivery schedules

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Concrete mixers and similar industrial applications

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Many stationary power plants and oil field applications

Now comes more profitable performance for the operators of stop-and-go vehicles—trucks, both highway and off-the-highway, garbage and trash collectors, concrete mixers, materials handling machines and others: smoother, more economical handling made possible by Clark's new TransVerter.

- **No heavy clutching—reduces driver fatigue. Easy control of hydraulic clutch by shift lever button, floor button, or light pressure clutch pedal**
- **Fine inching control with accelerator**
- **Gear shifting reduced appreciably. Gear changes made quicker**
- **Closely spaced ratios add to ease of shifting resulting in added transmission life**
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- **Longer life for entire drive-train—no shock-loading**
- **Less wheel slip—Tires last longer**
- **Clutch adjustment eliminated—Result: savings on costly down time**
- **Excellent accessibility for easy service. Serviceable without special tools by any mechanic familiar with transmissions**
- **Available for OEM or field conversion**

Get the interesting story of these advantages whose economies far offset the moderate additional cost. Send for bulletin.

CLARK EQUIPMENT COMPANY, Transmission Division, Falahee Road, Jackson 15, Michigan
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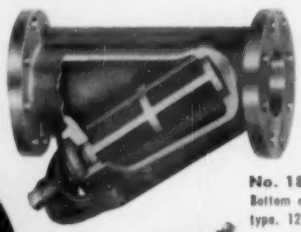
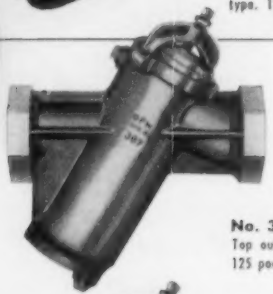
A Contamination-Free Product

No. 187
Bottom Outlet Type

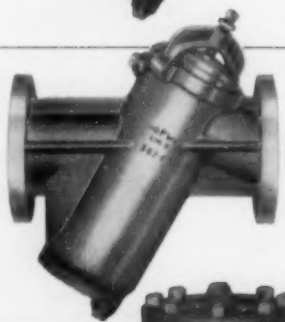
WITH OPW
line strainers



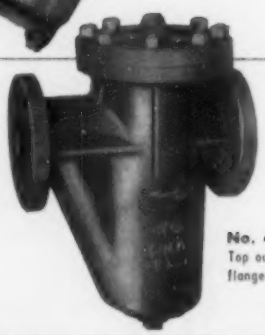
No. 187-F
Bottom opening
type. 125 pound.



No. 387
Top outlet type.
125 pound.



No. 387-F
Top outlet type
flanged. 125 pound.



No. 487-F
Top outlet type
flanged. 200 pound.

Is your product clean enough, your pump, meter and loading valve protected against scale, grit, dirt, rust and other foreign materials?

Be sure! Install OPW Line Strainers in any pipe line system for a cleaner product. Tight fit of cage and screen assures all product passing through strainer. Screen areas are many times pipe size for full flow. The simplicity of screen removal, cleaning and replacing facilitates regular, periodic checkup in the shortest possible time.

Choose your size, type and mesh! 125-pound standard or 200-pound high pressure types. Bottom or top outlet cage, reinforced for sturdiness and precision fit. Screwed or flanged end. Flanges, bolts and gaskets to suit. Strainer meshes from 14 to 300.

OPW CORPORATION

Valves, Fittings, Assemblies for the Liquids Handling Industries

2731 Colerain Ave., Cincinnati 25, Ohio
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Something new in mud

T-8

A Complete Mud Treatment

Simplified Mud Control

Greater Hole Stability

Lower Mud Cost

Proved by extensive field experimentation

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P. O. BOX 6504, HOUSTON 5, TEXAS

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Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION - HOUSTON

the Mid-Continent Supply Company

MACHINERY MAN

His job is to *Serve you!*

A staff of experienced machinery men is at your service when you order oil field equipment from Mid-Continent Supply Company. Their job is to serve you, to aid you in selecting equipment best suited to your requirements.

In rigging up your new equipment, Mid-Continent's Machinery Department engineering service and field supervision help assure money-saving drilling operation.

For a single item or a complete drilling rig "package", it pays to call Mid-Continent.

MID-CONTINENT
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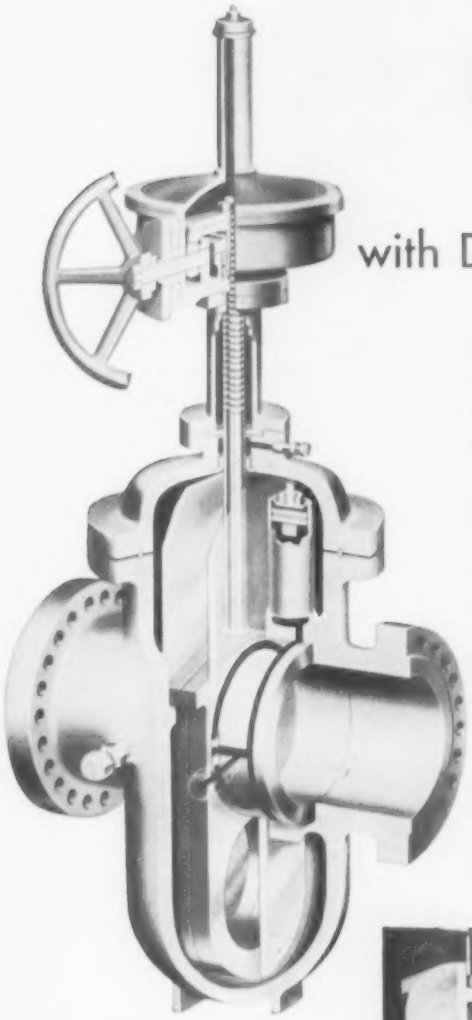
MID-CONTINENT BLDG FORT WORTH, TEXAS

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

NEW ADVANTAGES "GO ON THE LINE"

with DARLING-McEVOY Conduit Valves



Compare these features with *any* other pipe line gate valve:

1. EVERY CLOSURE LEAK-PROOF. No forcing. Positive, automatic self-sealing between seats and gate and seats and body by means of sealing compound.

2. NON-DIRECTIONAL. Flow may be in either direction.

3. TWIN SEALANT RESERVOIRS. One for each port. Sealant feeds automatically to downstream side only.

4. NEGLIGIBLE SERVICING. Leak-proof closure requires very little sealant. Reservoir capacity ample for a great many operations.

5. SMOOTH, FULL FLOW. No impediments. No turbulence. No pockets to collect sediment.

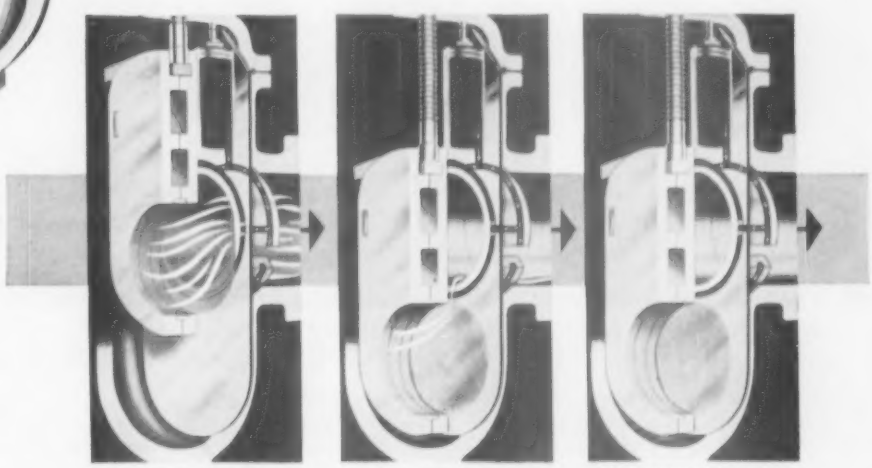
6. REPACKING UNDER PRESSURE. Construction permits replacement of stem packing media with valve wide open under full line pressure.

7. EXCEPTIONAL PERFORMANCE AND LIFE. Self-aligning gates. No wedging. Non-distorting seats, protected when valve is open or closed.

Darling-McEvoy conduit valves, made in 8" and larger sizes, are fully field proved and are now operating continuously on various major lines. For complete information on the self-sealing feature and many other advantages of this unique valve, ask for Bulletin 5402.

Above: *Cutaway showing heavy, self-aligning gate and parallel seat assembly, with one of the two sealing systems indicated.*

Right: *Diagrams of closure action on downstream side of gate.*



APPROACHING CLOSURE . . . *No loss of sealant as sealing groove in seat is disconnected from reservoir until gate is fully closed.*

CLOSED . . . *Jumper in gate now permits differential pressure to feed sealant into seat groove to check any remaining flow.*

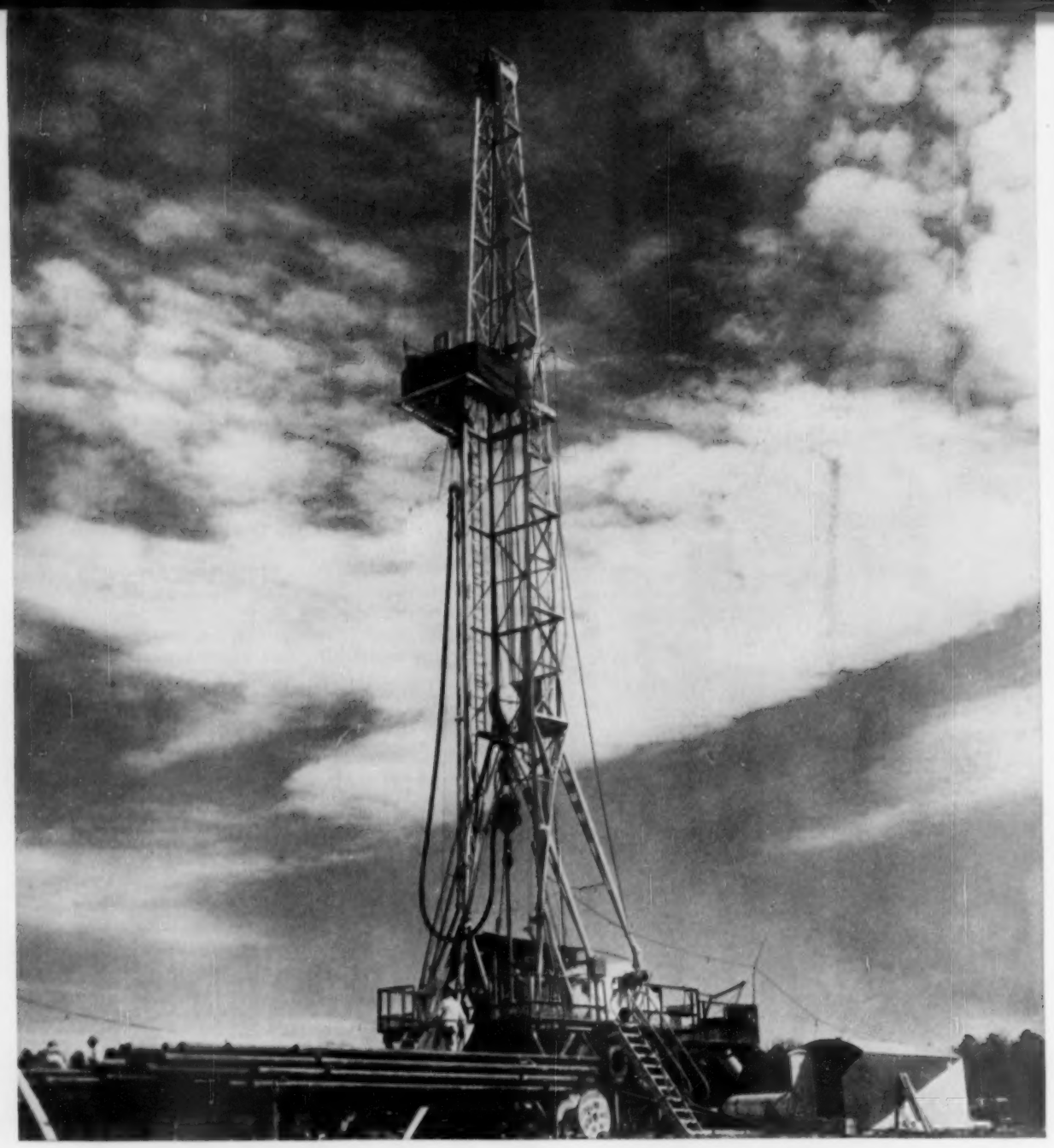
AUTOMATICALLY SEALED. *Pressures again in balance. Tightness established. No additional sealant used until again needed.*

DARLING VALVES

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario



New Drilling Rig Designed for Easy Moving

A portable drilling rig in every sense of the word, this all-Bethlehem outfit uses the S-45-E drawworks and companion equipment. It has proved excellent on field locations for slim-hole drilling. It has also been used for medium-depth service and workover jobs. The drawworks, heart of the outfit, has air-friction clutches and torque-converter drive. Every component of the rig fits perfectly into the trailer-mounted arrangement.

All-Bethlehem portable outfits can also be furnished for heavier service. A rig for shallow-to-medium conventional drilling and deeper slim-hole drilling will usually be built around Bethlehem's C-50 drawworks. This unit is equipped with torque-converter drive and offers a three-way choice of transmissions: two speeds forward, three speeds forward, or two speeds forward and one reverse. The C-50, though larger than the S-45-E, is nevertheless completely adaptable for trailer mounting. So, of course, are all other components used with this heavier drawworks.

Bethlehem portable rigs save transportation costs, and they're always ready for work soon after location is reached. They have proved their advantages in such widely separated fields as the Rocky Mountains, East Texas, and the Deep South.

BETHLEHEM SUPPLY COMPANY

General Offices: 21 E. Second St.
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West Coast Headquarters: Los Angeles, Calif.
Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York, N. Y.

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SOUTHERN UNION GAS COMPANY'S REMOTE CONTROLLED COMPRESSOR STATION—equipped with a Beaird-Ingersoll-Rand 550 h.p. 10 SVG compressor. Young radiator with lubricating oil cooler and gas coolers, and all necessary controls for unattended operation. Other sizes 110 to 660 h.p.

Southern Union Gas Company's Dogie Compressor station in El Largo Canyon, New Mexico, is more than 20 miles from the nearest paved highway and many miles farther from the nearest town. To boost gas from this lonely site Southern Union has installed a Beaird-Ingersoll-Rand 550 hp. 10 SVG packaged compressor.

Part of a 500-well gathering system, the Dogie Station compressor uses one stage of compression to pick up gas from 20 wells in nearby Ballard Field and boost it from 250 psig. to 500 psig. for delivery to the main line.

Normally inspected once a day, the station has been designed to overcome potential isolation caused by roads made impassable by deep snow, rain, swollen rivers and washes during severe San Juan winters. This problem of isolation has been solved by equipping the compressor with automatic controls and shut down devices that stand by day and night to protect the station and plant should any unusual operating condition occur. Now on a 40-hour weekly maintenance schedule, the station is capable of long periods of completely unattended operation.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your special operating requirements.

Packaged Compressor for —

REMOTE CONTROLLED

CANYON LOCATION

BEAIRD MACHINING MANUFACTURING STEEL WAREHOUSE

THE J. B. BEAIRD COMPANY, INC.

PACKAGED COMPRESSOR PLANTS

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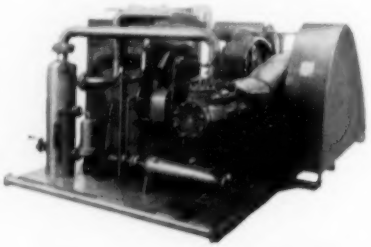
I-R EQUIPMENT DESIGNED FOR

air drilling

GYRO-FLO COMPRESSORS. This pair of 600 cfm Gyro-Flo rotary compressors, mounted on a single skid base, provides a compact and flexible source of power for air drilling at 125 psi pressure. These simple, rugged, rotary units are available in sizes from 125 to 600 cfm, driven by diesel, gasoline or natural gas engines.

TYPE ES COMPRESSORS. This compact, skid-mounted unit, packaged by Wilson Supply, is used to supplement the Gyro-Flo rig shown above, boosting pressure to 500 psi for air drilling through wet strata. Compressor is an Ingersoll-Rand Type ES unit, complete with gas engine drive and cooler.



GAS-ENGINE COMPRESSORS. Here, a 220-hp JVG gas-engine compressor provides ample pressure and capacity for aerated-mud drilling. Skid-mounted unit packaged by J. B. Beaird Co. includes cooling radiator, manifolding and I-R starting air compressor. Intercooler, after-cooler and automatic control and recording equipment shown in foreground. Similar units available in sizes to 600 hp.

3 Types of I-R Compressors offer air-drilling "power packages" for wide range of requirements

The use of compressed air, pressurized gas and aerated mud to remove cuttings has, in many cases, resulted in substantial gains in drilling speed and bit life.

Successful air drilling, of course, requires a compact, thoroughly dependable source of air power capable of delivering the proper volume and pressure for the particular operation. These requirements vary widely, according to depth of hole, type of ground, and whether or not water is encountered.

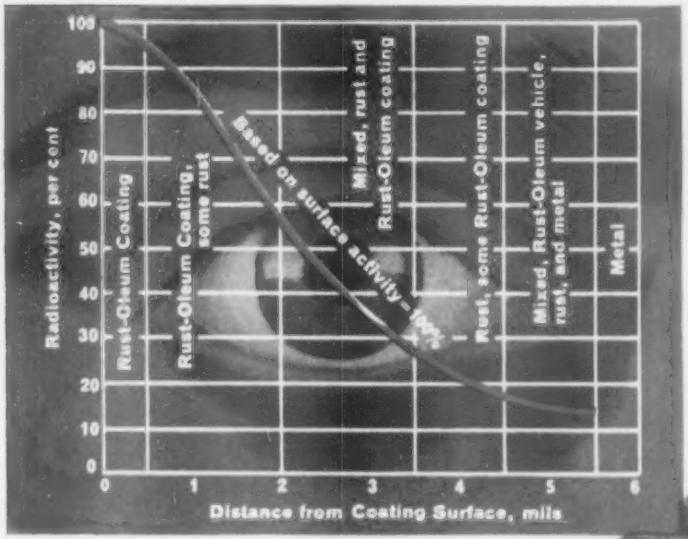
Whatever the conditions of air, gas or aerated mud drilling, there's an Ingersoll-Rand compressor that's *right* for the job. The three typical "power packages" shown here have been designed specifically for this type of work.

For complete details on equipment best suited to *your* particular needs, contact your nearest I-R representative. His experience can get you off to a good start in this promising new field.

Ingersoll-Rand

14-263 ♥ 11 BROADWAY, NEW YORK 6, N. Y.

See Rust-Oleum *penetrate rust* to bare metal through the "Eyes" of Radioactivity!



Curved line illustrates Rust-Oleum penetration through rust at each mil level as recorded by Geiger Counter.

Rust-Oleum dries to a firm, decorative coating that resists salt water, sun, fumes, heat, humidity, and weathering.

Geiger Counter traces Rust-Oleum penetration to bare metal! In nearly three years of radioactive research, Rust-Oleum's *specially-processed* fish oil vehicle was radio-activated and formulated into Rust-Oleum 769 Damp-Proof Red Primer – then applied to rusted test panels. Rust-Oleum's specially-processed fish oil vehicle was then traced through the rust to bare metal by Geiger Counter.

This penetration means rust-stopping power, because the fish oil vehicle works its way into the tiny pits in the metal where it drives out air and moisture that cause rust. Important savings are yours, because Rust-Oleum can be applied directly over sound rusted surfaces – usually eliminating costly surface preparations. Attach coupon to your business letterhead for your copy of the thirty-page report entitled, "The Development of a Method To Determine The Degree of Penetration of a Rust-Oleum Fish-Oil-Based Coating Into Rust On Steel Specimens," prepared by Battelle Memorial Institute technologists. Prompt delivery of Rust-Oleum is assured from your nearby industrial distributor.

There is only one Rust-Oleum. It is distinctive as your own fingerprint.

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STOPS RUST!

Rust-Oleum is available in practically all colors, including aluminum and white. See our complete catalog in Sweets, or write for information.

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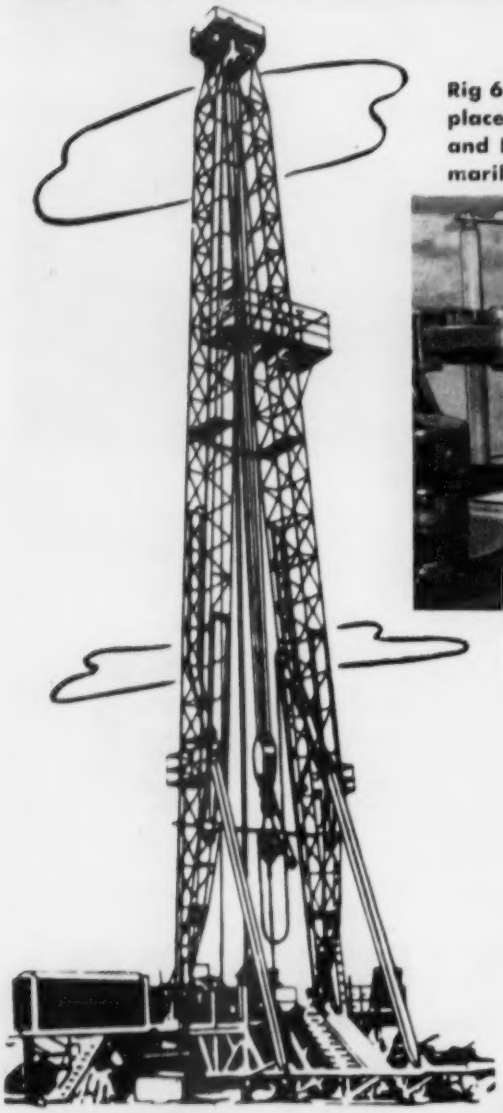
We Furnished One Of The MIGHTIEST And MOST ADVANCED Diesel Electric Drilling Rigs On The Gulf Coast



Rig 6, one of the most powerful rotary rigs in the world, has been placed in operation by the Circle Drilling Company of Lake Charles and Eunice, Louisiana. The big diesel-electric rig is designed primarily for marine operation.

The power package of Rig 6 is powered by three 1,100 horsepower diesel engines, each of which turns a pair of 800 kilowatt generators, powering four 1362 horsepower submarine propulsion motors. With a total of 3,848 installed horsepower, this rig is capable of drilling thousands of feet below any required depth in the foreseeable future.

Two of the big motors (rated for a total of 2,724 horsepower) drive the Ideco E-2500 draw-works and (through a torque tube) drive the rotary. Each 1000 horsepower mud pump is driven by a 1362 horsepower motor.

The 143-foot Ideco Full View Mast has a leg spread of 30 feet, and has a capacity of 940,000 pounds.

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SUPERIOR
IRON WORKS & SUPPLY COMPANY, INC.

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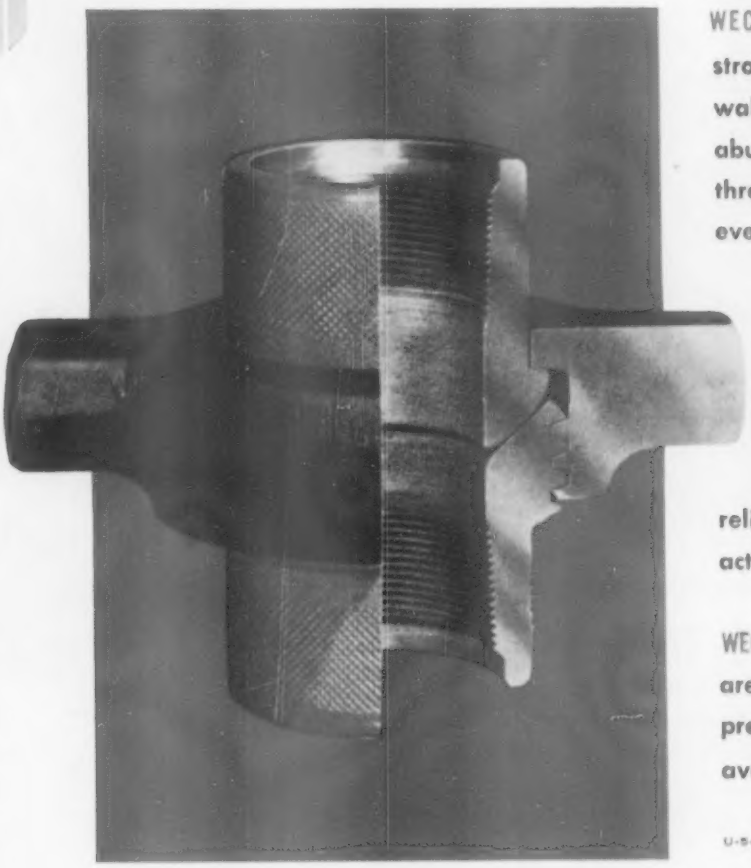


WECO UNIONS ARE BUILT RUGGED with stronger subs and wing nuts, heavier wall construction to take rough use-and-abuse in the field. Their rugged Acme threads make-up fast and accurately—even after repeated break-out.

WECO UNIONS ARE RELIABLE. Their famous metal-to-metal ball and cone seat gives positive protection against leaks from shock, surge and vibration. Because they provide such reliability, Weco Unions last longer—actually cost less in the long run.

WECO UNIONS ARE RIGHT wherever unions are required. And there's a size and pressure for every requirement. They're available from supply stores everywhere.

U-5-56

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

Now to supply **both**

Power

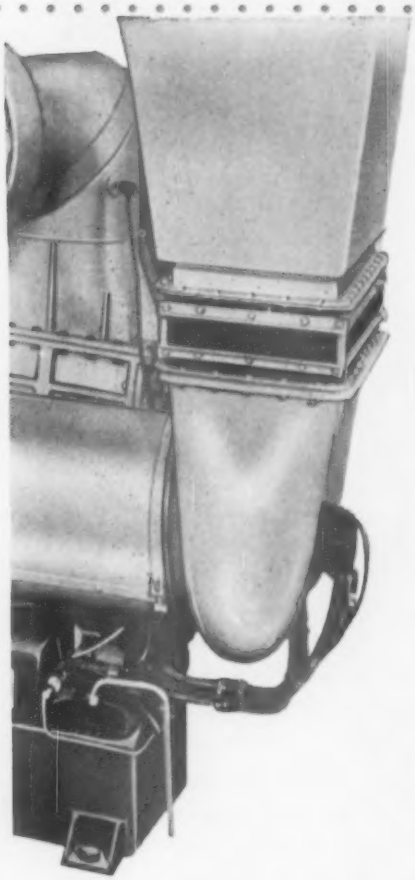
Clark introduces

Mark TA Features

Quick starting—2 minutes to full load
Quick shutdown—instantaneous—no turning gear
Field proved—forty units delivered
Light weight—less than 6 tons
Compact—only 16′ long, portable
Long life—conservative blade temperatures
Air cooled—long life—cool outer surface
Packaged—shipped assembled, ready to install
Fuel versatility—liquid or gaseous
Installation flexibility—up or down duct connections
Variable speed—physically separated turbines
Single combustion chamber—lasts a lifetime

and **Steam**

the **Mark TA** Gas Turbine



Power to drive a generator, pump or centrifugal compressor and low or high pressure steam for process use . . . the new Clark Mark TA 1130 bhp gas turbine will do both when equipped with a waste heat boiler. In addition to the 1130 bhp of rotative energy the turbine-boiler package will deliver 9500 lbs. of steam per hour at a combined fuel utilization of up to 79%. It's the most modern, compact and efficient power plant combination you can install!

The new turbine is also well suited to driving rotative loads without a waste heat recovery system. Its light weight, compactness and quiet, practically vibrationless operation makes it ideal for marine or portable use as well as for permanent installation.

Your nearest Clark representative will be pleased to give you all the facts about Clark gas turbines in sizes to 8500 bhp, or write for bulletin 142.

CLARK BROS. CO. OLEAN, NEW YORK

One of the Dresser Industries

Offices in Principal Cities Throughout the World

CLARK®

Gas Turbines

WHAT DO TRUCKERS WANT MOST?

FLEET OPERATOR: *"Our trucks must be on the job earning; not in the shop costing."*

MAINTENANCE MAN: *"My job is to hold truck operating and maintenance costs down to rock-bottom."*

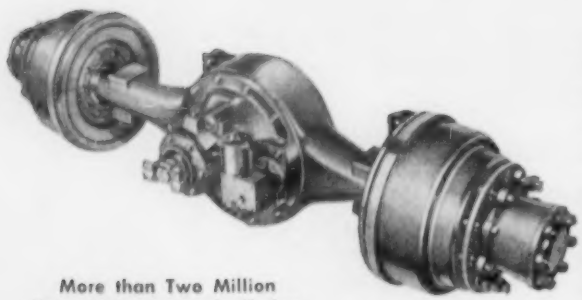
FARMER: *"Quick trips with full loads often make the difference between profit and loss on a whole crop."*

CONTRACTOR: *"We need power for tough off-highway work; and speed to go on the open road."*

EATON 2-SPEED AXLES SATISFY THEM ALL!

DRIVER: *"Every driver wants simple shifting, which means an easier-handling rig."*

DEALER: *"Higher resale values permit higher trade-in allowance — that makes satisfied customers."*



More than Two Million Eaton Axles in Trucks Today. For complete information, see your truck dealer.

Operators, drivers, maintenance men, dealers—just about everyone connected with any phase of motor truck operation agrees that Eaton 2-Speed Axles pay for themselves many times over. By providing the right gear ratio for every operating condition, Eaton 2-Speeds make trucks easier and safer to drive, reduce operating and maintenance costs, add thousands of miles of trouble-free life, and make them worth more on the trade-in.

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

PRODUCTS: Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioning Fastening Devices • Cold Drawn Steel • Stampings • Gears • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

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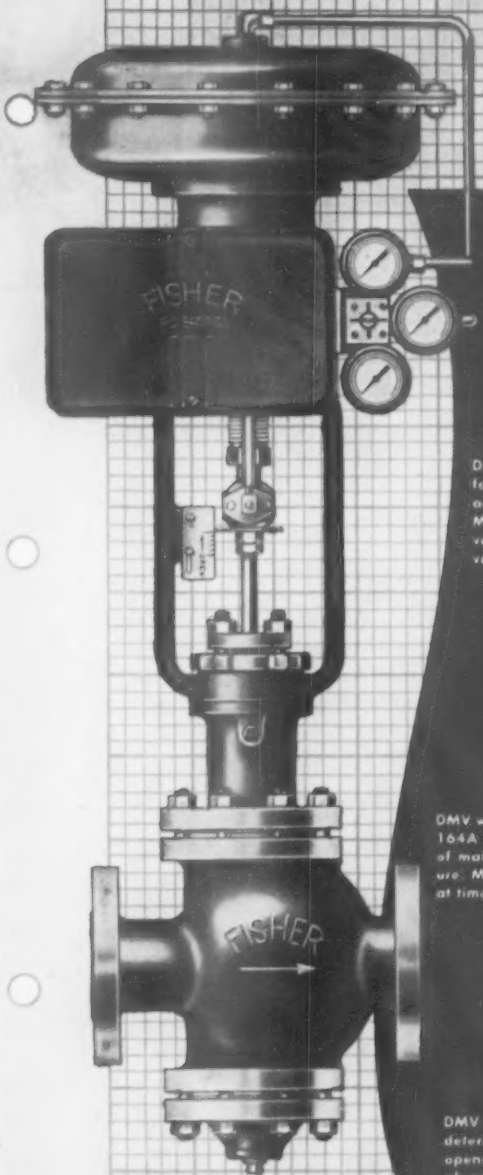
THE ANSWER TO YOUR *Control Problem*

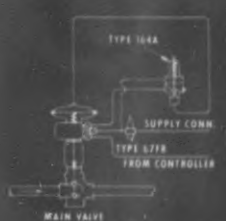
Built for your specific requirements, Fisher Diaphragm Motor Valves are manufactured to handle pressure conditions up to 30,000 pounds, for high pressure drops and are available in metals for highly corrosive service and alloys for high temperature work.



TYPICAL EXAMPLES OF FISHER DIAPHRAGM MOTOR VALVE WIDE RANGE ADAPTABILITY

DMV with Hand Jack Operator. Allows for manual operation against spring action. Limits travel of valve. Example—Maximum opening in spring opened valve. Minimum closing in spring closed valve.

DMV with Continuously Connected Handwheel. Operator can open or close valve against controller action. Can operate valve manually if operating medium fails. Can set maximum opening or minimum closing of inner valve.



DMV with Air Lock-up system using Type 164A to close air circuit to diaphragm of main valve in case of plant air failure. Main valve will be held in position at time of supply pressure failure.

DMV with Remotely Actuated Electric Solenoid Trip Out. Valve may be fully opened or closed by unloading operating pressure from diaphragm by solenoid operation. Solenoid is actuated from manual switch or an electric tie-in circuit.

DMV with Air Cut-out Feature. At predetermined pressure setting, unloader opens and bleeds pressure off diaphragm to keep main valve open. Unloader orifice is larger than controller orifice so main valve remains open. Operation restored by putting thumb over open end of unloader.

DMV with Auxiliary Controller Override. An auxiliary controller, such as temperature, placed in operating air line to diaphragm—can over-ride action of main control function by unloading diaphragm and taking over functional operation of DMV.

FISHER GOVERNOR COMPANY

MARSHALLTOWN, IOWA • WOODSTOCK, ONTARIO

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER *Since 1880*

When you invest

...Specify National Seamless Oil Country Tubular Products. In oil fields throughout the world, you'll find USS NATIONAL Seamless Drill Pipe, Casing and Tubing constantly on the job, safeguarding production. Rough and ready to be worked hard, and ready to meet the higher stresses of drilling deeper holes tomorrow.

These NATIONAL Seamless Oil Country Tubular Products are known the world over for their outstanding service record in deep-well work. The secret of their strength and dependability may be attributed to two things—quality steel and a unique method of manufacture. Each seamless tube is pierced from a solid billet of steel. And only steel of the very best forging properties and of the highest uniformity can be used, since the piercing operation tends to search out any defects in the metal.

Thus, NATIONAL Seamless Oil Country Tubular Products are built to take the worst that oil well drilling has to offer—*built to give you more service and better service for every dollar you invest.* Remember *that*, the next time you order drill pipe, casing, or tubing.

SOME SIGNIFICANT DEVELOPMENTS BY NATIONAL TUBE...

NATIONAL DEOXIDIZED BESSEMER STEEL CASING AND TUBING—GRADES H-40, J-55—Especially well-suited for oil production because of its combination of high yield strength and good ductility.

NATIONAL WARM-WORKED CASING—GRADE N-80—An extremely high-strength casing possessing a uniformity of physical properties which gives it high collapse resistance and greatly increased joint strength. Hydrostatically tested to 80% minimum yield strength up to a maximum of 10,000 psi.

NATIONAL DEEP-WELL CASING—A stronger casing than is provided under A.P.I. specifications, to meet constantly increasing depths. Due to the severe service for which it is intended, it is hydrostatically tested to 80% of minimum yield strength up to a maximum of 12,000 psi.

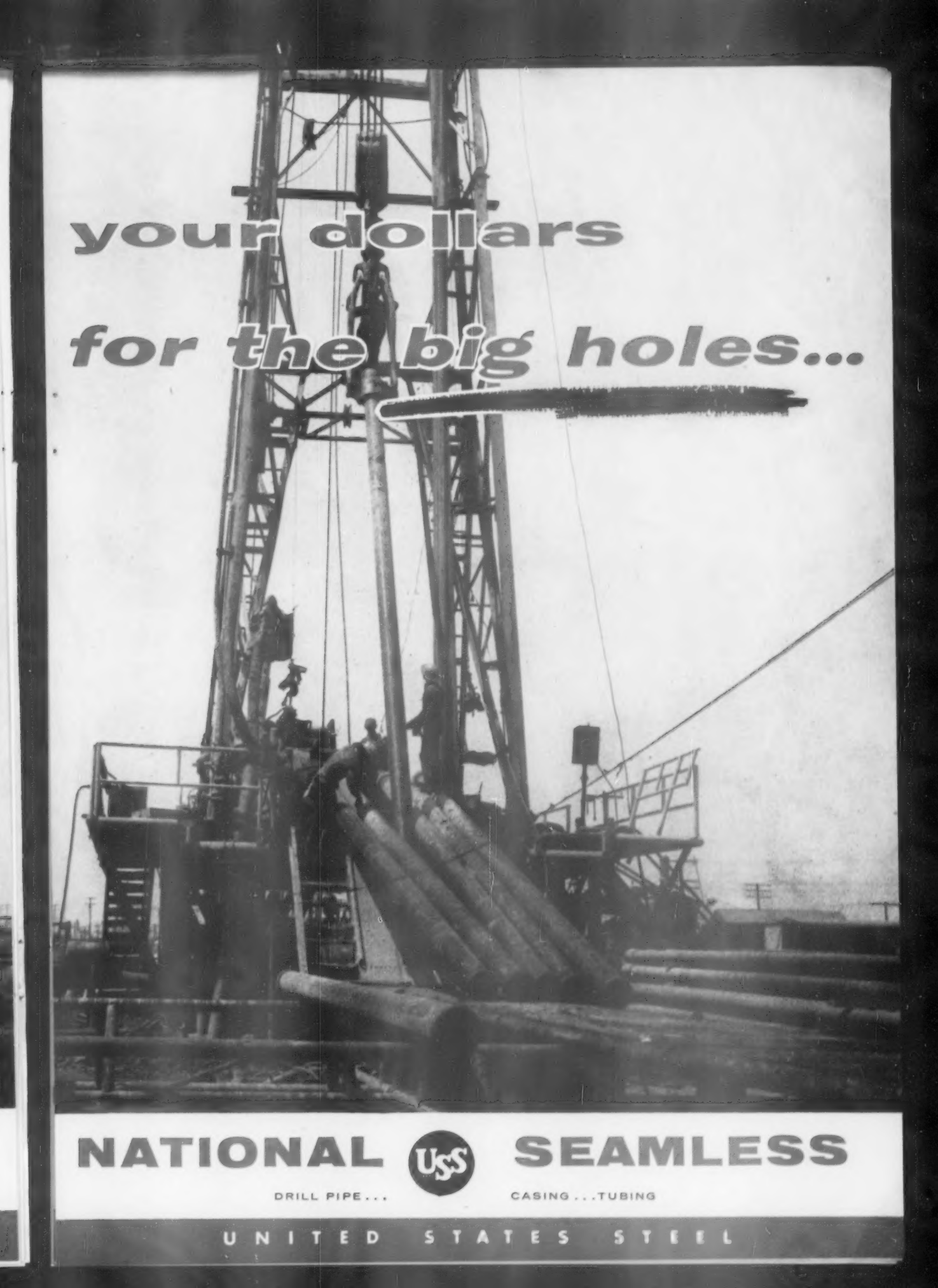
NATIONAL (B) BUTTRESS-THREAD CASING—Developed to satisfy the need for a casing joint which will safely and economically support the weight of deep-well casing. The buttress-thread joint is comparable in strength to that of the body of the pipe.

For further information, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Ask for Bulletin No. 15.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

SEE The United States Steel Hour. Televised alternate weeks. Consult your local newspaper for time and station.

UNITED STATES STEEL


your dollars
for the big holes...
NATIONAL
USS
SEAMLESS
DRILL PIPE...
CASING...TUBING
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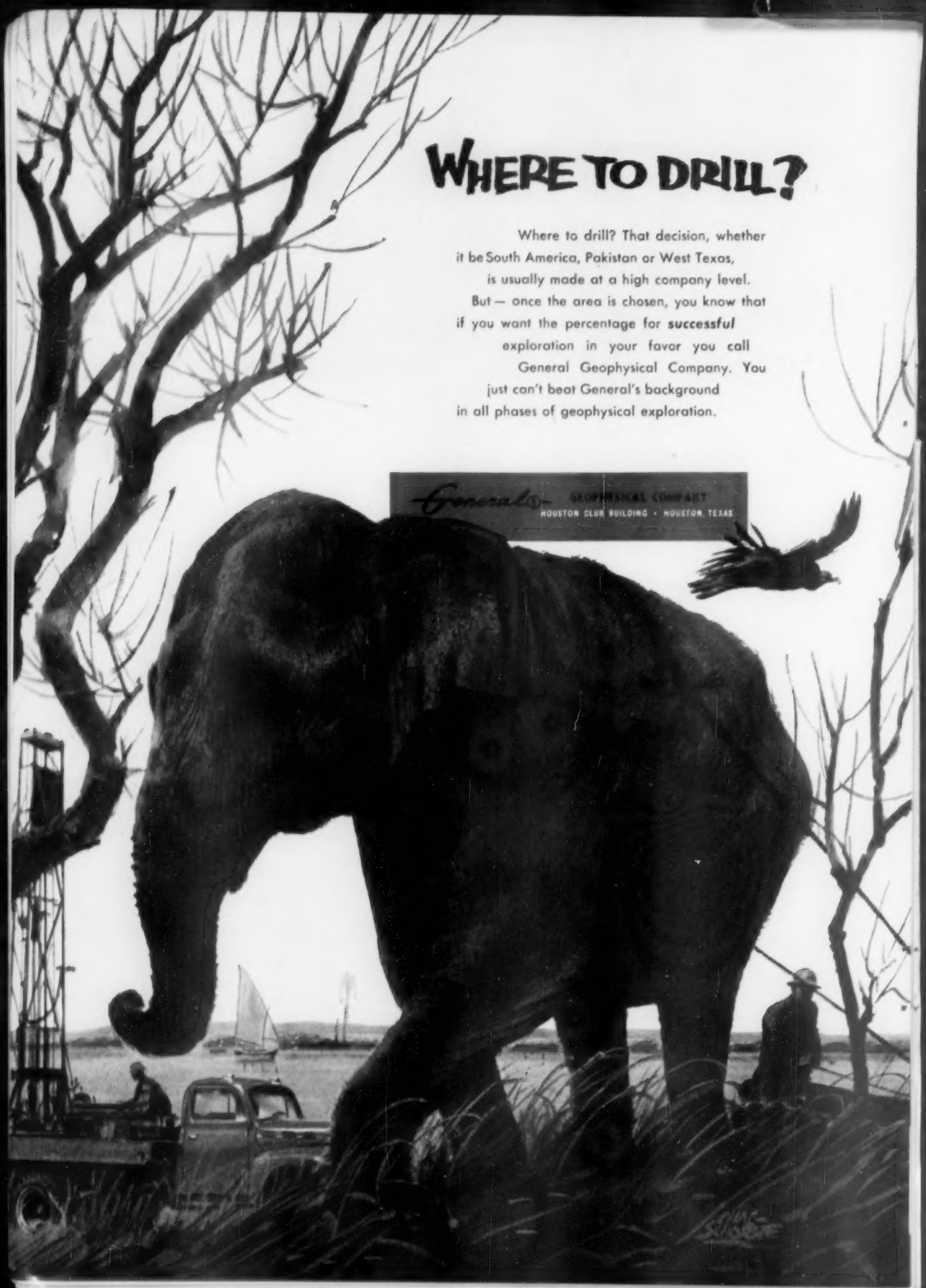
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Where to drill? That decision, whether it be South America, Pakistan or West Texas, is usually made at a high company level. But — once the area is chosen, you know that if you want the percentage for **successful** exploration in your favor you call General Geophysical Company. You just can't beat General's background in all phases of geophysical exploration.
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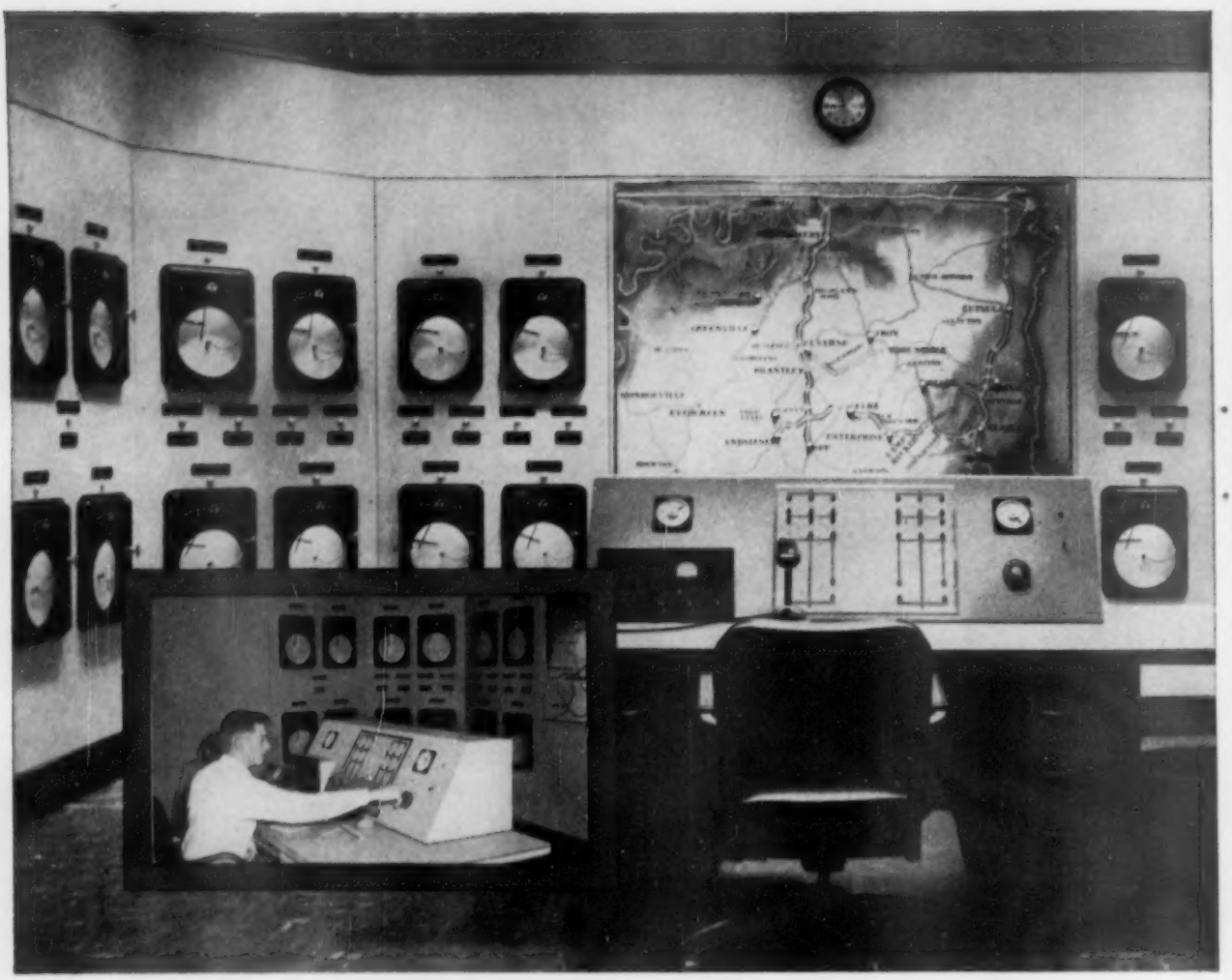
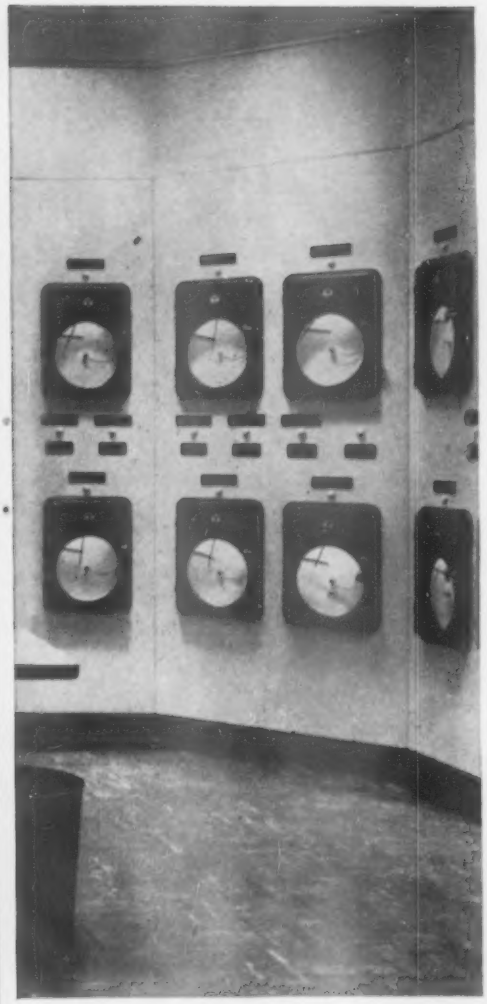
PLEASE CONTACT OUR NEAREST OFFICE

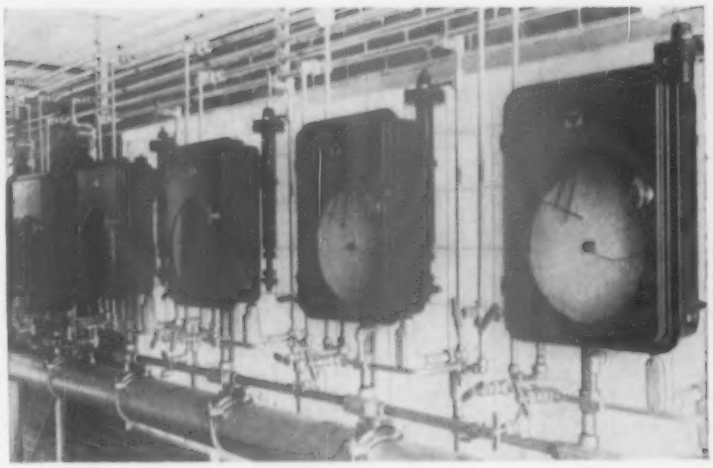


Remote Control of Flow and Pressure for 24 cities and towns in Alabama

ANOTHER ALL AMERICAN® INSTALLATION — From a centrally located desk in Andalusia, Alabama, one dispatcher, by remote control, regulates the flow of gas for the 24 cities in the Southeast Alabama Gas District—largest municipal natural gas system in the world. The 120 years engineering and precision manufacturing experience of American Meter Company assisted by supplying equipment for this new type modern gas measurement and control installation to bring the advantages of natural GAS to one of the fast-growing areas of the United States.



DISPATCHER STATION – By dialing a single circuit, dispatcher obtains total flow in cubic feet and pressure from each of the 14 city gate stations, plus total flow in cubic feet, pressures and differentials of orifice meters and controllers at each intake station to permit complete remote dispatching.



INTAKE STATIONS — All measurement at intake stations, 90 miles and 120 miles from dispatcher's desk, is combined in a totalizing relay which in turn is put on a memory relay to supply total flow since last dialing.

CITY GATE STATIONS – Each station has American automatic measurement, pressure and regulation equipment, totalizing relays and memory relays, enabling dispatcher to obtain flow for any period and obtain pressures. Complete remote control of dual flow differentials, dual first and second stage regulators.

AMERICAN®
METER COMPANY
INCORPORATED ESTABLISHED 1874

GENERAL SALES OFFICE: Somerton, Philadelphia 16, Penna. • Albany • Alhambra • Atlanta • Baltimore • Birmingham • Boston • Chicago • Dallas • Denver • Erie • Houston • Kansas City • Los Angeles • Minneapolis • New York • Omaha • Pittsburgh • San Francisco • Seattle • Tulsa • Wynnewood
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SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

HIGH PRESSURE RURAL SERVICE REGULATORS

THE PERMANENCE OF GIBRALTAR

Rector Casing Heads' Ring-of-Steel Seal

Like the famous rock—the welded seal in Rector's Casing Heads assures you PERMANENT COMPLETIONS unequaled in the oil industry. It will not burn out, deteriorate, flow under high pressure or temperature, or freeze and contract under low temperature, requires no maintenance, eliminates pressure equalization between strings.

This enduring permanence is made possible by Rector's specially designed Welding Ring and the application of an API ring gasket. On your next well specify Rector—the Cadillac of Casing Heads with the sealed-with-steel permanence of Gibraltar. More than 100,000 in service.

At authorized supply stores everywhere.

RECTOR WELL EQUIPMENT COMPANY INC

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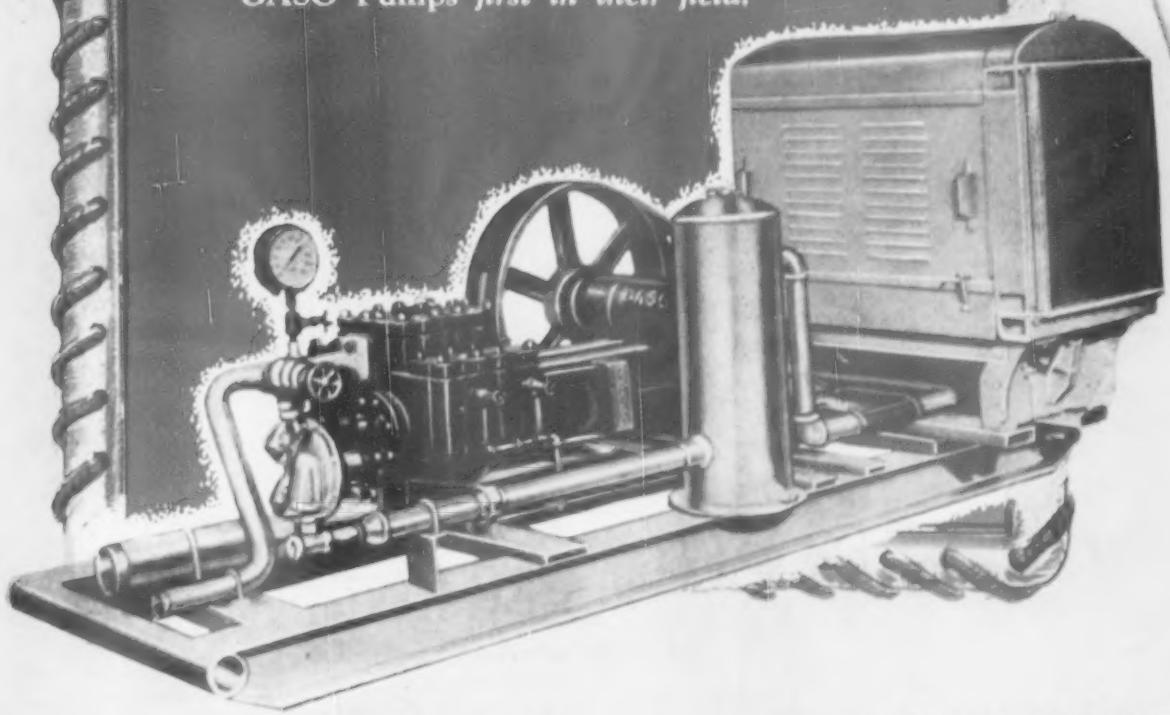
Houston Plant: 2215 Commerce St.

REPRESENTATIVES IN ALL ACTIVE FIELDS

2 × 2 / 4 Simple arithmetic!

Pumps that deliver *top* performance for *longer* periods of time yield a *bigger* return on the investment. That's what makes GASO Pumps *first in their field.*



SERIES 1800—Light, compact, for crude oil gathering lines and booster stations, water lines, salt water disposal, slush and acidizing service. Fig. 1849: 41 to 113 GPM at 900 to 350 PSI. Fig. 1847: 41 to 143 GPM at 900 to 275 PSI. Fig. 1845: 254 to 370 GPM at 220 to 150 PSI.

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GASO PUMPS
for every oil industry need

GET GASO DEPENDABILITY IN WATER FLOODING, TOO

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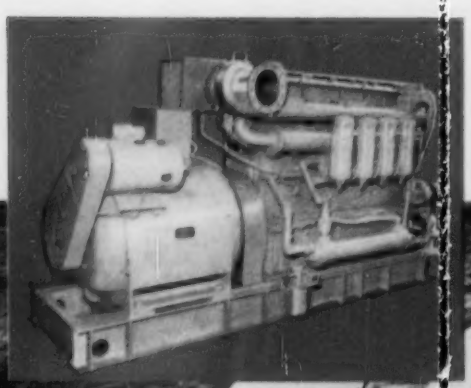
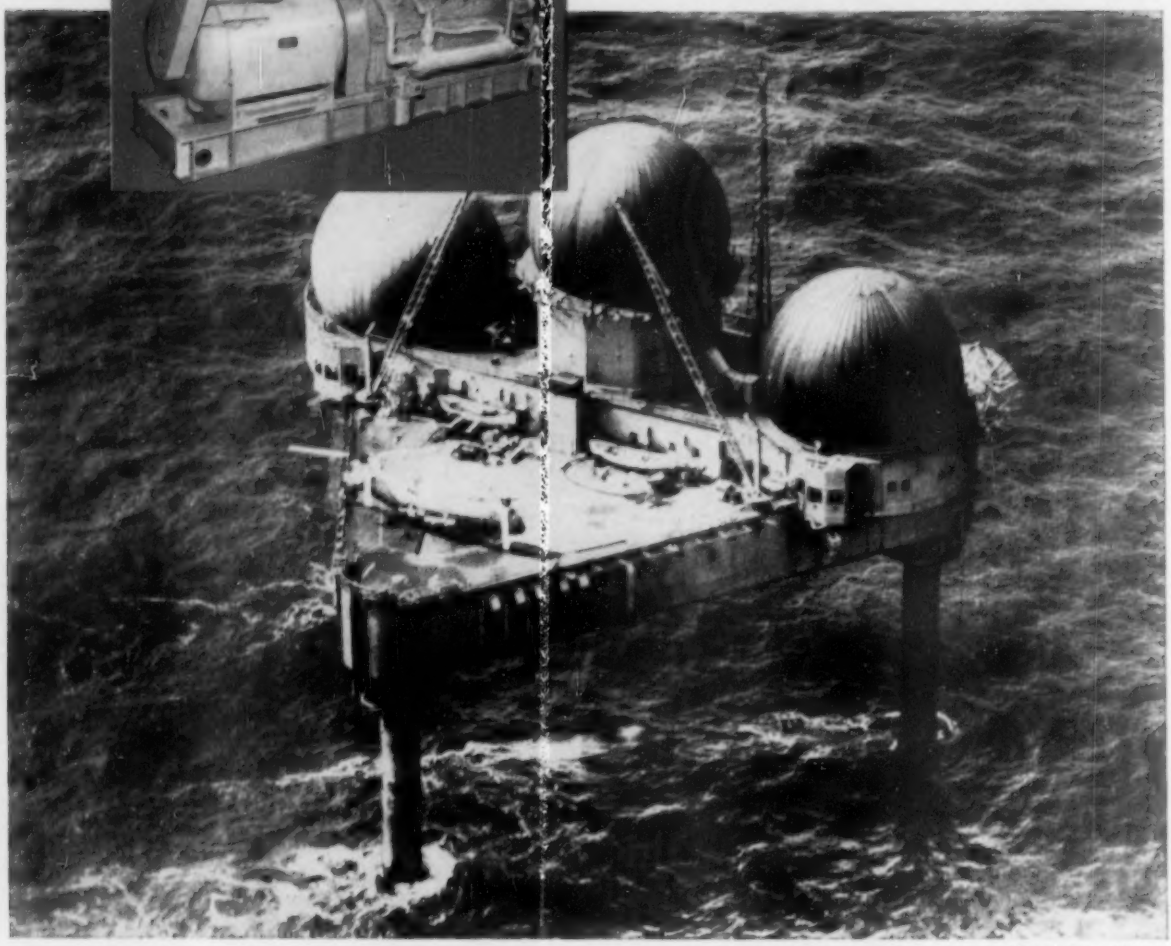


Powered by
White's Superior Diesels...



United Press Photo

TEXAS TOWERS' WARNING WILL ALERT OUR NATION

This U. S. Air Force early warning radar station off the coast of Cape Cod is called the Texas Tower. Aboard the Tower, radar eyes search the skies. In the event of approaching enemy bombers, a push of one red button will warn our coastal areas and start our air defense into action!

Two more Towers are now being built for the U. S. Air Force by the U. S. Navy, to be a vital part of our nation's far-reaching radar air defense system. They require high-quality, heavy-duty equipment giving dependable performance with minimum maintenance over long periods of continuous service. White's Superior Diesel engines meet these requirements . . . they have been selected to generate the power for the vital radar operations, and also for the radio, communication, heating, lighting and ventilating equipment aboard the additional Towers.

If you require rugged, heavy-duty, high-quality Diesel engines for the most dependable and economical operation, choose White's Superior Diesels. There's a size and type for virtually every requirement from 215 to 2150 horsepower, or 150 to 1500 KW. Get complete information now.

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THE WHITE MOTOR COMPANY *Plant and General Offices: Springfield, Ohio*

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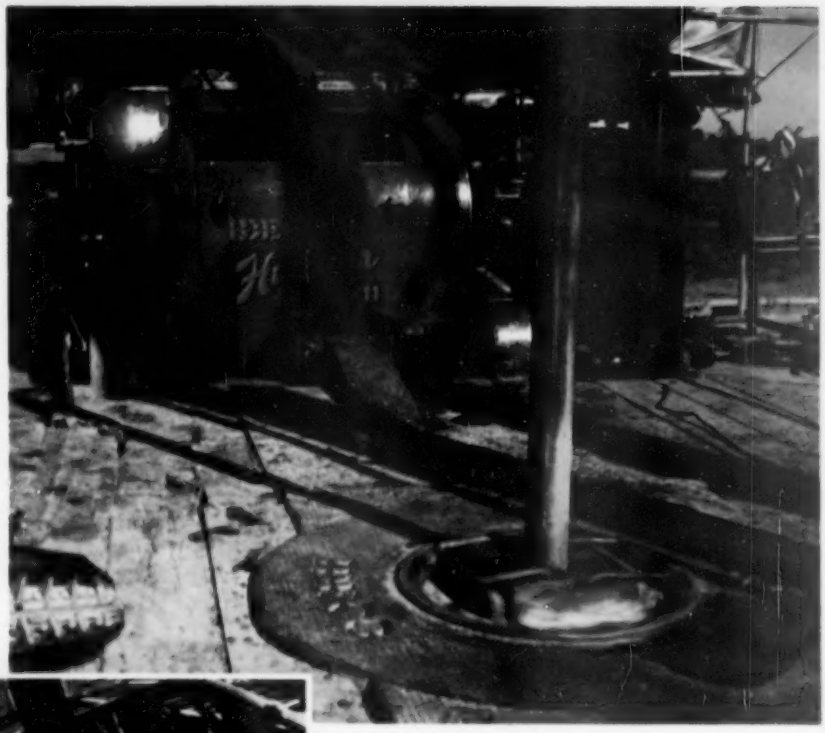
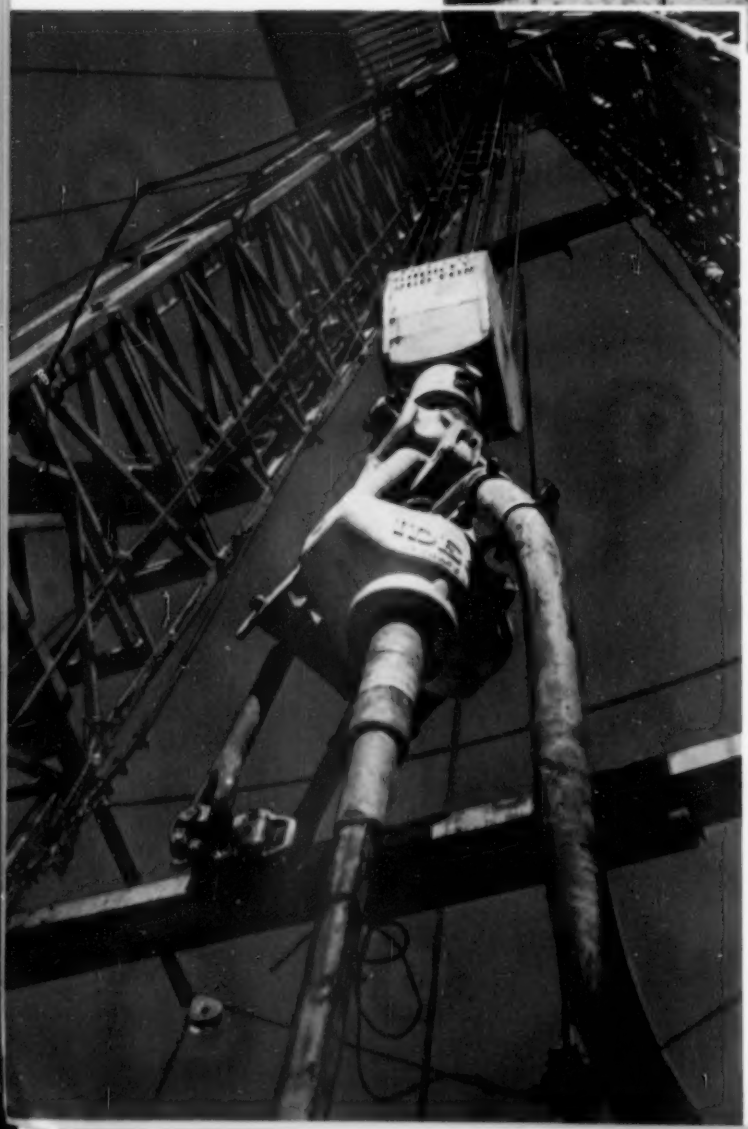
WITH
J&L SUPPLY
A driller who moves in with J&L equipment has the comfortable assurance of good friends and efficient parts service at hand 24 hours a day. In the United States and Canada J&L maintains 91 supply stores, 22 sales offices, and a vast network of resident salesmen.
J&L
This J&L package includes the Ideco Full View Mast with all the advantages of a standard drilling derrick, but is more easily moved in and rigged up. Heights to 143'. Hookload capacities to 650,000 lbs. Free standing. Ideal for barge drilling. Dependable J&L parts service.

Ideco is the world's most wanted drilling equipment. Highly perfected Power or Hydrair Rigs and Streamlined Rotaries place the driller in complete command of his operations. One-third of all rotary tables in use are Ideco. Table openings from 14½" to 27½"; dead load capacities from 75 to 300 tons. Rig capacities (4½" drill pipe) to 20,000'.





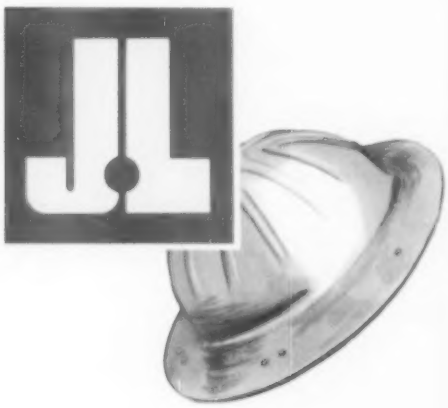
Ideco Shorty Block, Ideco Streamlined Swivel, Republic Rotary Hose — a fast, dependable trio.

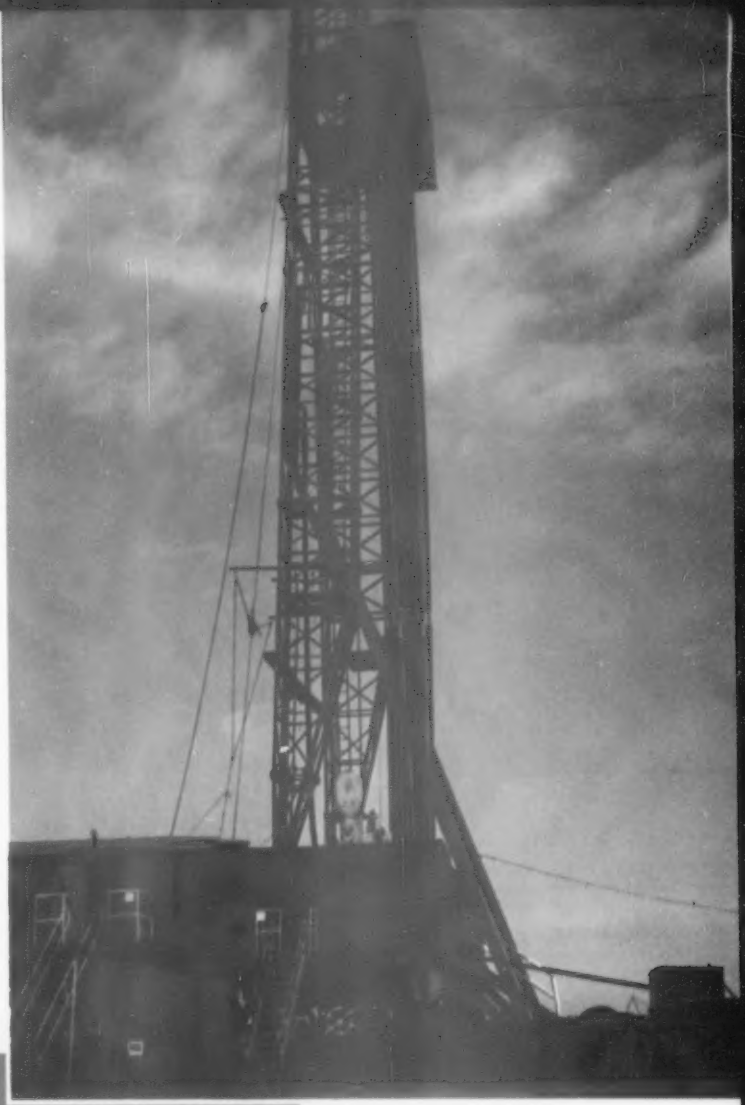
The Ideco Shorty Block unitized with hook reduces over-all length by as much as 9 feet. The sheaves ("Fabriform") are a unique Ideco development for yielding added ton-miles to the life of your wire rope. Shorty Block rated capacities to 400 tons.

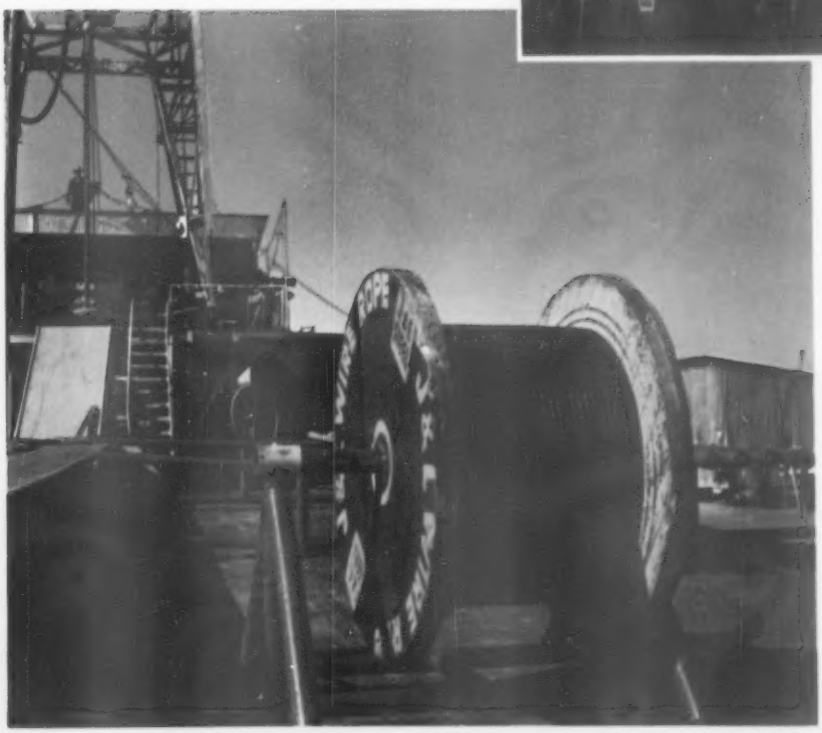
Ideco Streamlined Swivels with rated dead load capacities to 300 tons. Drillers commonly complete four or five wells before replacing washpipe or packing in an Ideco — a one-man job, with about 20 or 25 minutes down-time.

Republic Rotary Hose has a patented connection drillers like — the higher the pressure the tighter the seal.

J&L Blue Ribbon Drill Pipe has to its credit the world's deepest holes. It gives a crew confidence that makes for faster, safer drilling. Made to exceptionally rigid standards, internal or external upset, from Blue Ribbon Heat-Treated Alloy Steel or Blue Ribbon plus Vanadium Heat-Treated Alloy Steel. Available in Integral-Joint with A. P. I. Tool Joint Threads, or upset for tool joint application.



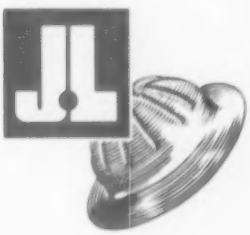




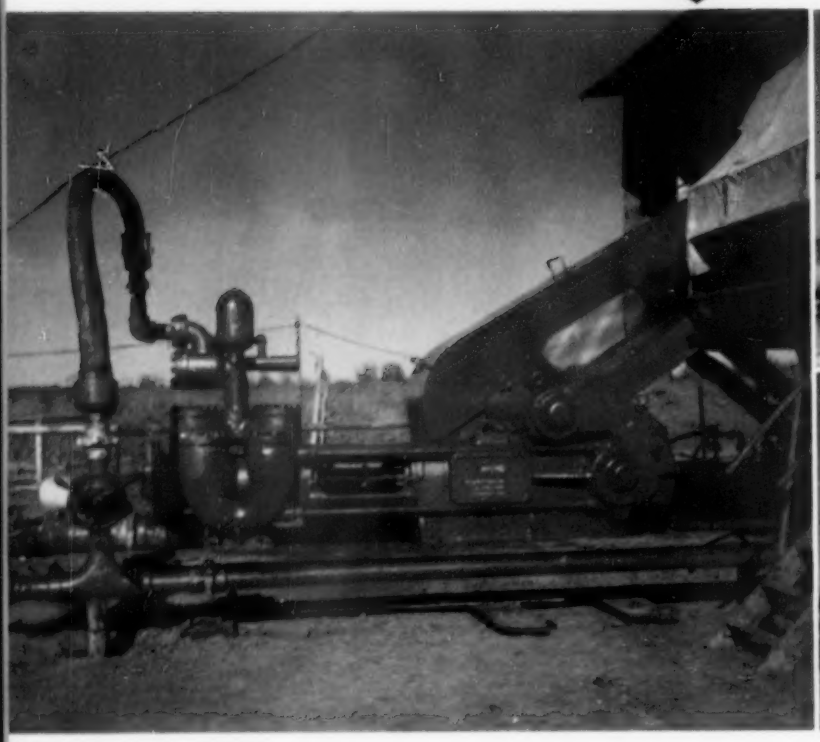
J&L Wire Rope also holds the world's records for deep drilling.

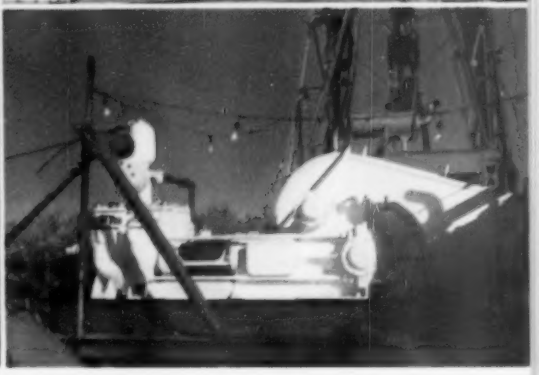
Your choice of Independent Wire Rope Center or SpringKore for rotary drilling. J&L SpringKore Rotary Line has a tightly coiled steel spring core. Flexible, but made to resist crushing, and holds more lubricant.

For cable tool work your choice of PlastiKore or Fiber core lines. PlastiKore is impervious to acids, caustics, and other underground destructive fluids.



This pump delivers the mud! It's the Wheland Duplex in three sizes, compact and comparatively light, but tough as a rhino. Highly accessible — and you get 24-hour J&L parts service. Left, the 350 Horsepower HP-14,000 7½" x 14". Upper right, the 750 Horsepower HP-18,000 7¾" x 18". Lower right, the 220 Horsepower HP-8,000 7¼" x 12".





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Equipment, Parts, Quality, Service, Appreciation.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

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KINNEY Heliquad Gear Pump

AURORA Close-coupled Centrifugal Pump

The Pulse of Petroleum and Petro Chem Production—

PUMPS

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Liquid Handling Pumps. AURORA Centrifugals and deep well Turbines, 7000 gpm, 500 ft. heads. APCO Turbine-Type, 150 gpm, 600 ft. heads. Condensate Return Units.

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Boston, Mass.

KINNEY Vacuum Pumps, 0.2 micron, capacity to 5000 cfm; KINNEY Rotating Plunger and Heliquad Liquid Handling Pumps, to 3000 gpm.

VACUUM EQUIPMENT DIVISION

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Complete KINNEY Vacuum Systems, Equipment and Components, Vacuum Research and Engineering.

KALAMAZOO DIVISION

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HYDRECO Gear-Type Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 3 to 52 hp; Cylinders; Control and Auxiliary Valves; 1500 psi.: DUDCO Dual-Vane Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 7 to 140 hp; 2000 psi operation.

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Watertown, N. Y.

Railroad air brake equipment of all types; STRATOPOWER Hydraulic Pumps for Aircraft, to 3000 psi.

Always on the move... from well to tank farm and tank ship... from oil field to pumping station... from pipe line to refinery... oil and gas in their many consistencies, reach their final destination through Pumps. Surveys show that the petroleum industry requires a greater variety of Pump types and Pump sizes than any other. These surveys also show that Pumps made by Divisions of The New York Air Brake Company play important roles in keeping petroleum on the move *economically*.

For crude, diesel fuel, lubricating and other light oils there are AURORA Centrifugal Pumps by the thousands. APCO Turbine-type Pumps handle the gasolines, naphthas and other volatile, non-lubricating fluids. For tars, waxes, bunker fuel and asphalt KINNEY Rotating Plunger and Heliquad Gear Pumps move the seemingly "unpumpables" along the road to the consumer. But, the services rendered to Petroleum (as well as other industries) by The New York Air Brake Company go well beyond the sphere of Liquid Handling equipment.

The Kalamazoo Division, for example, produces the DUDCO and HYDRECO Fluid Power components, so well known throughout industry, for rotary tables, cat heads and the numerous functions of portable drill rigs. DUDCO Fluid Motors serve to open and close remote pipe line valves.

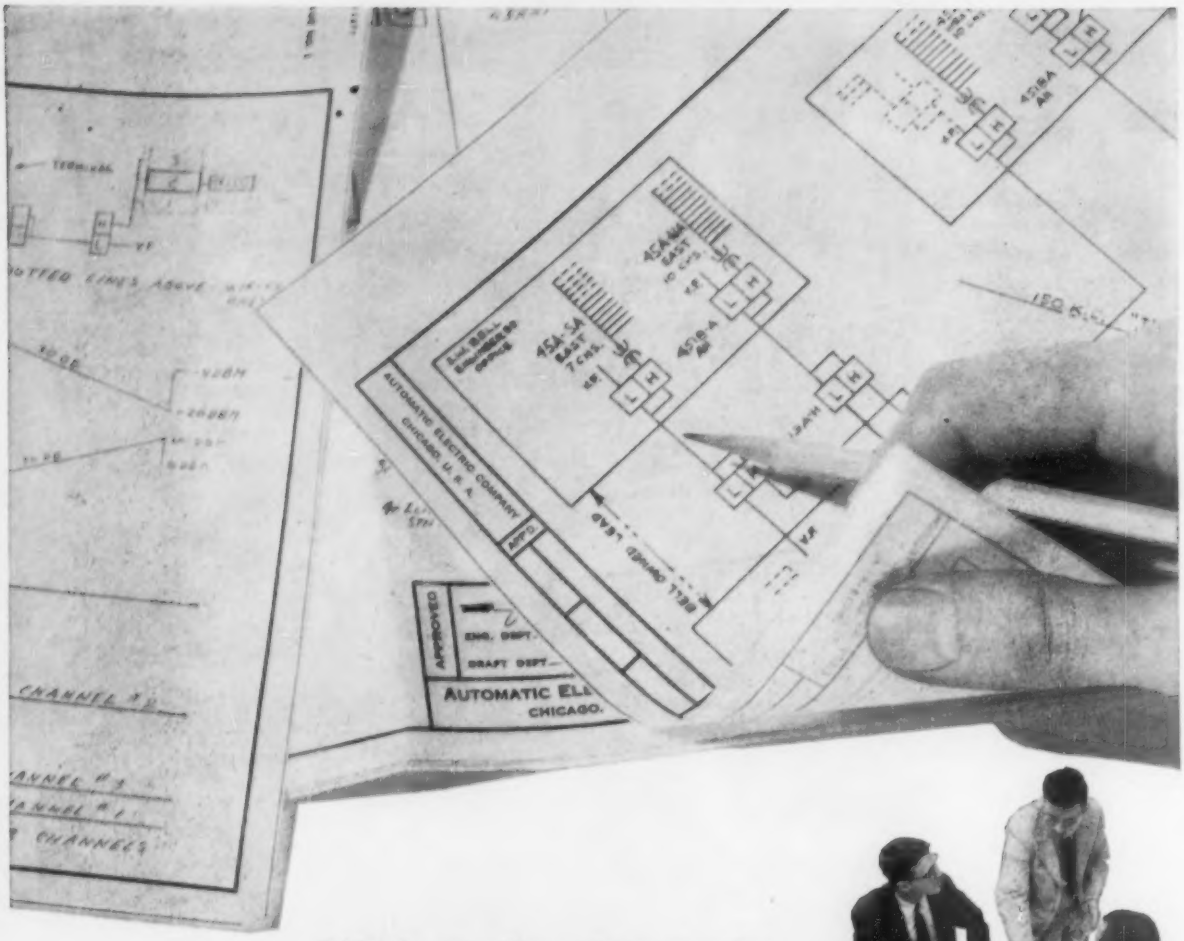
In the areas of distillation and petrochemical production, the KINNEY MFG. Division makes a significant contribution with KINNEY High Vacuum equipment. Last, but not least, The New York Air Brake Company furnishes the added factor of safety to tank cars that transport petroleum products—the Air Brake equipment for which the company is named.

Read this company's fascinating story of diversification and progress. Write for Bulletin 1102.

THE NEW YORK AIR BRAKE COMPANY

230 PARK AVENUE • NEW YORK 17, N. Y.

INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.



Lift the mystery from carrier

with Automatic Electric's **"PACKAGE PLAN"**

Automatic Electric's "Package Plan" makes it easy for you to add carrier equipment in providing the circuits you need, without overloading your engineering and installation staff.

Combined in this "Package Plan" are Lenkurt's "Engineer, Furnish and Install" Service and Automatic Electric's "Follow-Thru" Engineering. Together, these services are all that's required to handle your job—and do it economically.

SPECIFICALLY, HERE'S WHAT WE DO—

Analyze Your Needs. Automatic Electric's "Follow-Thru" engineers study your communications problem and give you a complete over-all plan. If rearrangements are necessary in your present equipment, outside plant, or circuit layout, the most economical way is suggested. The correct carrier equipment for each specific part of the plan is recommended—*and you are told why.* The resulting circuits will function as an integral part of your over-all operations—not as an accessory that is "grafted on" as an afterthought.

Engineer, Furnish, and Install. Each carrier system is engineered to your requirements, pre-assembled, wired and tested by Lenkurt, using the most modern and precise techniques. Lenkurt "E F & I" technicians handle all the details of installation and turn the system over to you, ready to "cut over" for service on the promised date.

Train to Operate and Maintain. Lenkurt engineers will train your men to operate Lenkurt equipment right on the job. They furnish detailed equipment bulletins, line-up and operating instructions, and maintenance techniques.

"Follow-Thru" Engineering always available. Automatic Electric's "Follow-Thru" Engineering Service does not stop with the planning stage, or even with the cut-over; it is available *throughout the life of your Lenkurt Carrier.*

A letter or call will bring an Automatic Electric carrier engineer with all the facts on our "Package Plan". *Write or call* Automatic Electric Sales Corporation, 1033 West Van Buren Street, (HAymarket 1-4300), Chicago 7, Illinois. *In Canada:* Automatic Electric Sales (Canada) Ltd., Toronto. *Offices in principal cities.*

AUTOMATIC ELECTRIC

Originators of the dial telephone • Pioneers in automatic control

GENERAL TELEPHONE SYSTEM

the Biggest One Yet!

LUFKIN'S *new*

CB - 912DA - 168 - 35

- 14 FOOT STROKE
- 35000 LB. CAPACITY
- 912000 IN. LB. PEAK TORQUE

To fulfill the ever growing demand for longer stroke, greater beam capacity, and more effective counterbalance, Lufkin is proud to present this giant new unit which is capable of handling the heaviest pumping jobs in the field today.

The design of this new 14-footer features the same well known **RUGGEDNESS** and **DEPENDABILITY** which has made LUFKIN units the standard of comparison the world over.

Lufkin **FOUNDRY & MACHINE COMPANY**

LUFKIN, TEXAS

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Lufkin equipment in Canada is handled by THE LUFKIN MACHINE CO., LTD. 9950 65th Avenue, Edmonton, Alberta, Canada 3913 18th Avenue, Regina, Saskatchewan, Canada

A meter,

a generator,

a cord...

3 *simple elements that usher in a new era of drilling-control instrumentation*

Here are some brand-new tachometers that were developed with you in mind. They are electric, completely *self-energizing* instruments for the measurement of rotary-table speed, pump-stroke count, and engine RPM that you will find to be the most versatile and adaptable drilling aids you have ever used.

These instruments have their own generators that transmit low-voltage signals through electric cords to meters installed wherever you need them. Not being hampered by the rotating shafts, as were used on the old types of tachometers, the new instruments make a whole new concept of instrumentation possible.

Now you can have meters as far from the take-off points as you need. Now you can have multiple metering, that is, several meters getting their signals from a single source, or a grouping of several meters, each getting its signal from a different pump or engine—or you can have both. Now the driller, the derrickman, the mechanic, anyone who needs information about the rig's function, can have the instrumentation he needs. You can also have simple recorders to make a permanent record of these operations.

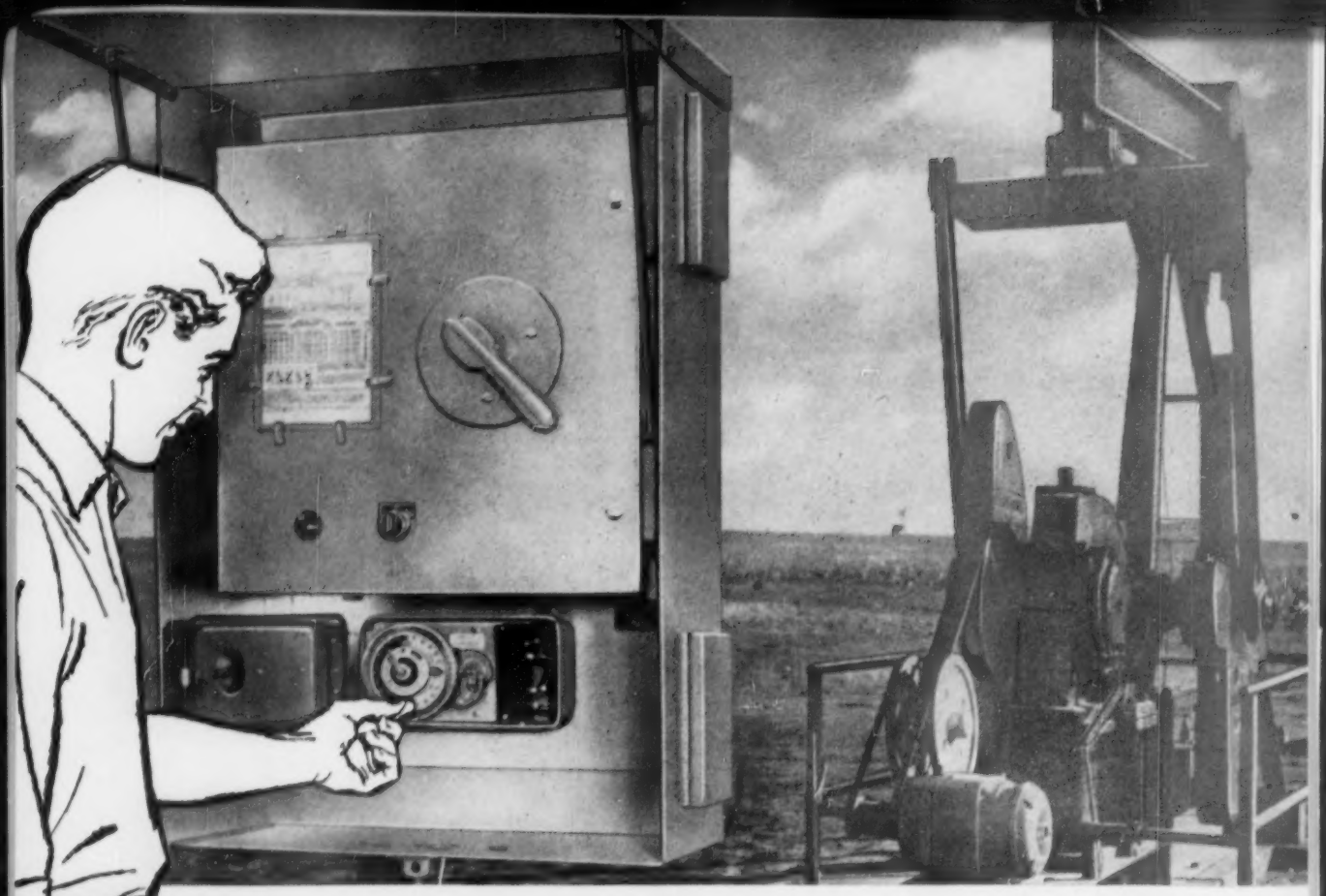
With these new tachometers it is so simple for the driller to keep his pump performance under constant surveillance. The distance from the pump to the driller's position presents no problem, since the metering system consists merely of a generator on the pump, a meter in the drilling-control panel, and a cord to connect the two. Yet, for all their simplicity of operation, they are precision instruments that indicate correct pump speed at all times.

The adaptability of these instruments doesn't end here. A tremendously important feature of these instruments is their ability to be moved from rig to rig, with little need for concern about the gear ratios used. The pump-stroke tachometer and the rotary-table tachometer each has a screw adjustment on the side of the meter that allows you to calibrate the instrument right on the rig. Consequently, you don't have to stock different types of tachometers for different types of engines and different types of rotaries. You merely install the instrument and make a simple screwdriver adjustment to make its indication agree with the actual RPM. You can use it on one operation after another. These tachometers will last and last and last.

Find out how the new design in tachometers can revolutionize the instrumentation on your rig. Write for free literature from the Martin-Decker Corporation, 3431 Cherry Avenue, Long Beach 7, California.

MARTIN-DECKER CORP.

HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA



"Practically thinks for itself"

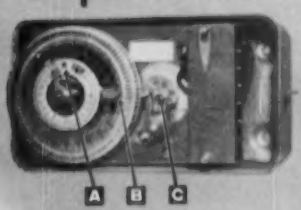
The new Cutler-Hammer Three-Star Oil Well Pumping Control has performed so successfully and proven so completely dependable that the leading oil field men everywhere insist on C-H control for all their pumping wells and accept no substitutes. Ask these men why and they will tell you, "That new C-H three-star control beats them all. No matter how tough it gets, our pumps keep pumping; and that Supertimer practically thinks for itself." Your first pumping well equipped with Cutler-Hammer control will prove to you what these men know . . . Cutler-Hammer Three-Star Oil Well Pumping Control will out-perform, out-protect, out-last and serve better than all others.

This control has *everything*, particularly the engineered dependability so vital in any automation . . . nothing is left to chance. Insist on the finest, insist on Cutler-Hammer . . . leading manufacturer of *automation* control.

Your nearby Authorized Cutler-Hammer Distributor is stocked and ready to serve you. Order from him today. CUTLER-HAMMER, Inc., 1453 St. Paul Avenue, Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

Member American CUTLER-HAMMER MOTOR CONTROL C-H *Petroleum Institute*

New CUTLER-HAMMER Supertimer



This is *automation* in action. You pre-set the Supertimer to meet your field allowable and the control will do the rest, automatically. It starts, stops, restarts and cycles indefinitely, precisely according to your schedule. If a power outage occurs, any number of C-H controlled pumps can be restarted in an exact sequence to avoid overloading the power lines on inrush. Unfortunate coincidental starting of even two pumps is impossible.

- **A** Sets the precise restarting time delay from zero to 180 seconds. This is exclusive with the Supertimer—random starts or coincidental starts of even two pumps are impossible.
- **B** Sets the daily pumping schedule—pull a tab for each fifteen minutes of pumping, space them through the daily 24 hour period as desired.
- **C** Sets the weekly pumping schedule—1, 2, 3, 4, 5, 6 or 7 days per week as desired.

COMPLETE PROTECTION
The control is protected against lightning with exclusive, advanced-designed lightning arresters; and the three coil overload relay protects the pump motor from overloading and dangerous single phasing which often results from lightning.

CHIMNEY DRAFT VENTILATION
The heat-reflecting, aluminized enclosure insures a constant circulation of air . . . no nuisance tripping because of trapped heat.

DUST SAFE CONTACTS
Dust-Safe vertical contacts stay clean and eliminate the necessity of contact replacement common to other designs.

JONES
TYPE 2
medium to heavy loads in non-corrosive fluids.

JONES
TYPE 7
Heavy loads in corrosive fluids.

JONES
TYPE 12
Deep wells, heavier loads... no increase in rod size.

THERE'S A JONES ROD FOR EVERY PUMPING CONDITION

Trouble-free, longer lasting service is assured when you select the Jones rods designed and made for your particular pumping conditions. There are none better.

JONES
SUCKER RODS

Look for the "GREEN" Rods

PESA

THE S. M. JONES COMPANY
Division of Buffalo-Eclipse Corporation

General Office and Factory: **TOLEDO, OHIO**
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"From spud to pay I beef up

Watch NCAA football Saturday afternoon, NBC-TV.

US
RUBBER

my rigs with 'U. S.' products..."

says toolpusher "Red" Royal

Hard-driving, hard-working "Red" picks "U. S." products to "put muscles" on his rig. He knows from experience that "U. S." products are the *best* insurance against downtime he has ever found. They are designed and made by men who know all about oil field problems—men who are out to help the driller get more and more footage—in less and less time—at less cost.

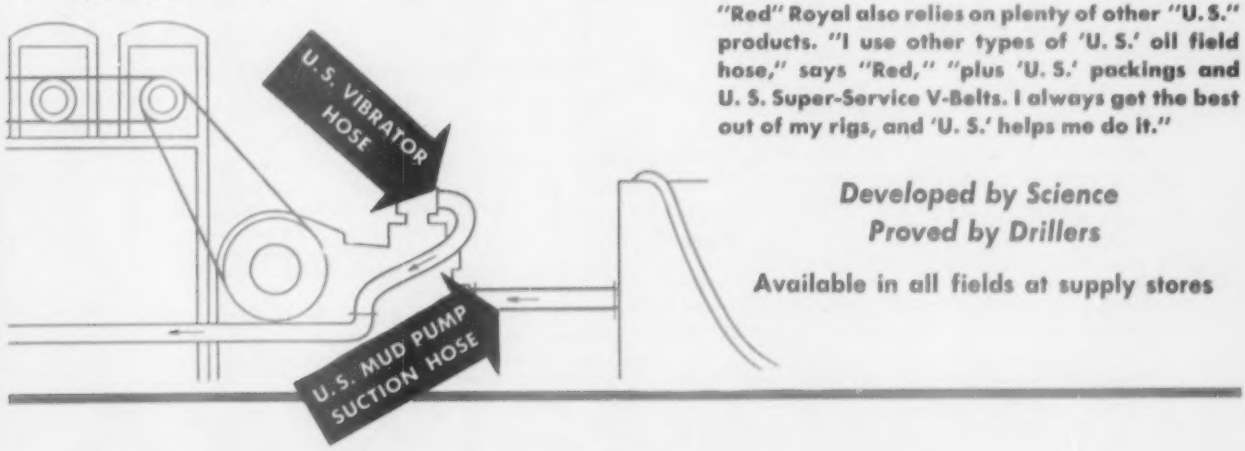
"I use it all the way from spud to pay—no switching of hose!" says "Red" Royal about U. S. ROYAL 4 ROTARY HOSE.
"In Texas, just one U. S. Royal 4 drilled over 300,000 feet in over 3 years, at a hose cost of less than a penny a foot drilled!" No need to keep money tied up in stand-by hose to finish wells. U. S. Royal 4 handles the highest pressures . . . no downtime in order to switch. No lubrication needed; complete flexibility from nipple to nipple.

"I insist on belts that have *proven* they wear longer. That's why I always see to it that U. S. RAINBOW® V-BELTS are on my rigs."
Take, for instance, this performance record: On a composite drive U. S. Rainbow V-Belts drilled over 218,970 feet of hole, moving from location to location. At last count, they were still on the job after 43 months. The contractor says the belts he had previously used *failed after three wells.*

"Withstands the highest pressures met in today's drilling operations."
U. S. MUD PUMP VIBRATOR HOSE (P-8087).
Standard equipment between mud pump and standpipe. Does away with broken pipe and loose connections. Takes up misalignments between mud pump and mud line. Speeds rig-up time.

"The hose that can't collapse!"
U. S. GIANT HEAVY DUTY MUD PUMP SUCTION HOSE P-8048.
High flexibility permits quick adjustment of the intake of the line to the right position in the slush pit without changing connections. This hose keeps air out of the line, prevents mud ends from blowing, reduces wear on valves and pistons, and often saves 2 or more connections in each line. Will not collapse, thanks to heavy spring-steel coil construction. Handles chemically-treated or oil-base mud, or crude oil.

"Red" Royal also relies on plenty of other "U. S." products. "I use other types of 'U. S.' oil field hose," says "Red," "plus 'U. S.' packings and U. S. Super-Service V-Belts. I always get the best out of my rigs, and 'U. S.' helps me do it."



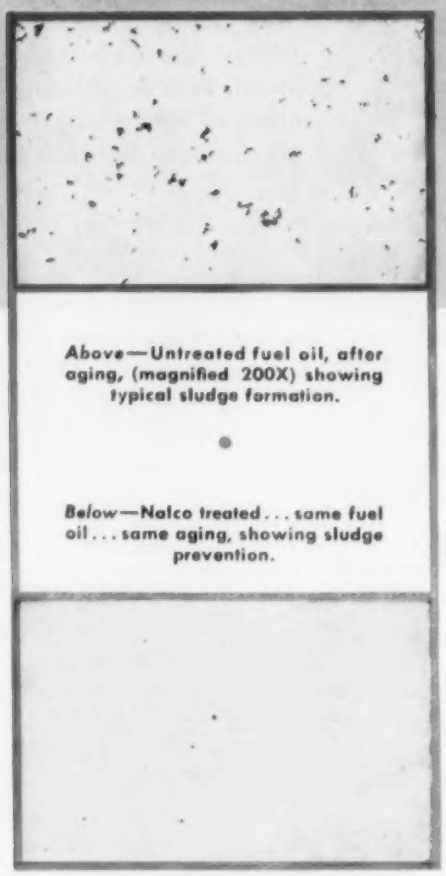
Developed by Science
Proved by Drillers

Available in all fields at supply stores

Mechanical Goods Division

United States Rubber

STABILIZE
DISTILLATE FUEL OILS
with *Nalco* Fuel Oil Treatments



Above—Untreated fuel oil, after aging, (magnified 200X) showing typical sludge formation.

Below—Nalco treated . . . same fuel oil . . . same aging, showing sludge prevention.

- STOP COLOR DEGRADATION
- PREVENT SLUDGE FORMATION
- INHIBIT RUST AND CORROSION

and

- FLUIDIZE OLD SLUDGE DEPOSITS

Action of Nalco Fuel Oil Treatment on your distillate fuel adds up to better marketability, easier handling, and lower storage tank and oil line maintenance costs. Nalco stabilization protects the original color of distillate oils, controls sludging tendencies . . . assures salability despite storage and handling delays that frequently deteriorate untreated oils. And once sold, Nalco treated oils perform better . . . cut down customer complaints of filter or screen clogging and burner fouling.

Nalco treatments give you all these benefits at low chemical dosage . . . and at low chemical cost.

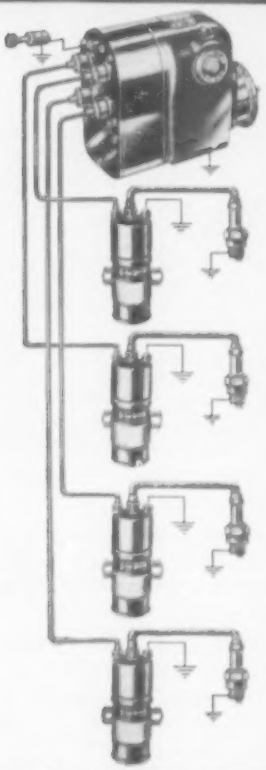
CLEAN TANK BOTTOMS

Sludge deposits in tanks of residual fuel and crude oil can be cleaned up quickly and conveniently with powerful dispersion type treatments offered by Nalco. Labor costs are eliminated, maximum storage capacity is restored, and *sludge is converted to usable oil.*

Write or phone today, for full data on Nalco stabilizers and dispersants . . . the effective, low-cost way to protect your equipment, *and to safeguard product quality.*

NATIONAL ALUMINATE CORPORATION
6242 West 66th Place • Chicago 38, Illinois
Telephone: POrtsmouth 7-7240
In Canada: Alchem Limited, Burlington, Ontario

A *Nalco*® **PRODUCT . . . Serving the Petroleum Industry through Practical Applied Science**



for Large Bore Stationary Gas Engines

AMERICAN BOSCH

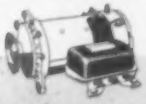
LOW TENSION MAGNETO IGNITION SYSTEM

The System comprises the American Bosch MRB Low Tension, shielded Magneto and individual High Tension Ignition Transformers mounted at each engine cylinder. (See 4 cyl. installation diagram at left). Low tension current, generated in the Magneto, is distributed through low tension leads to the Transformers. Here, the electrical energy is stepped-up to high voltage and conducted to the spark plugs by short cables—shielded if desired. The rugged, heavy-duty, high tension Transformers (as illustrated above) are available with or without shielding for use in the American Bosch System or other low tension systems employing magneto or battery ignition.

Energy losses and corona effects which occur with long high tension cables are eliminated. The possibility of fire and explosion hazard is minimized where engines operate in combustible vapors . . . radio and TV interference may be greatly reduced by complete shielding. These important advantages, combined with the outstanding electrical and mechanical features of the American Bosch Low Tension Magneto, offer maximum spark efficiency for large bore, stationary engines operating under severest conditions. For peak engine performance and safer, continuous service, get the facts from American Bosch, Springfield 7, Mass. A Division of American Bosch Arma Corporation.

AMERICAN BOSCH

Automotive and Aviation Magnetos



Generators and Regulators

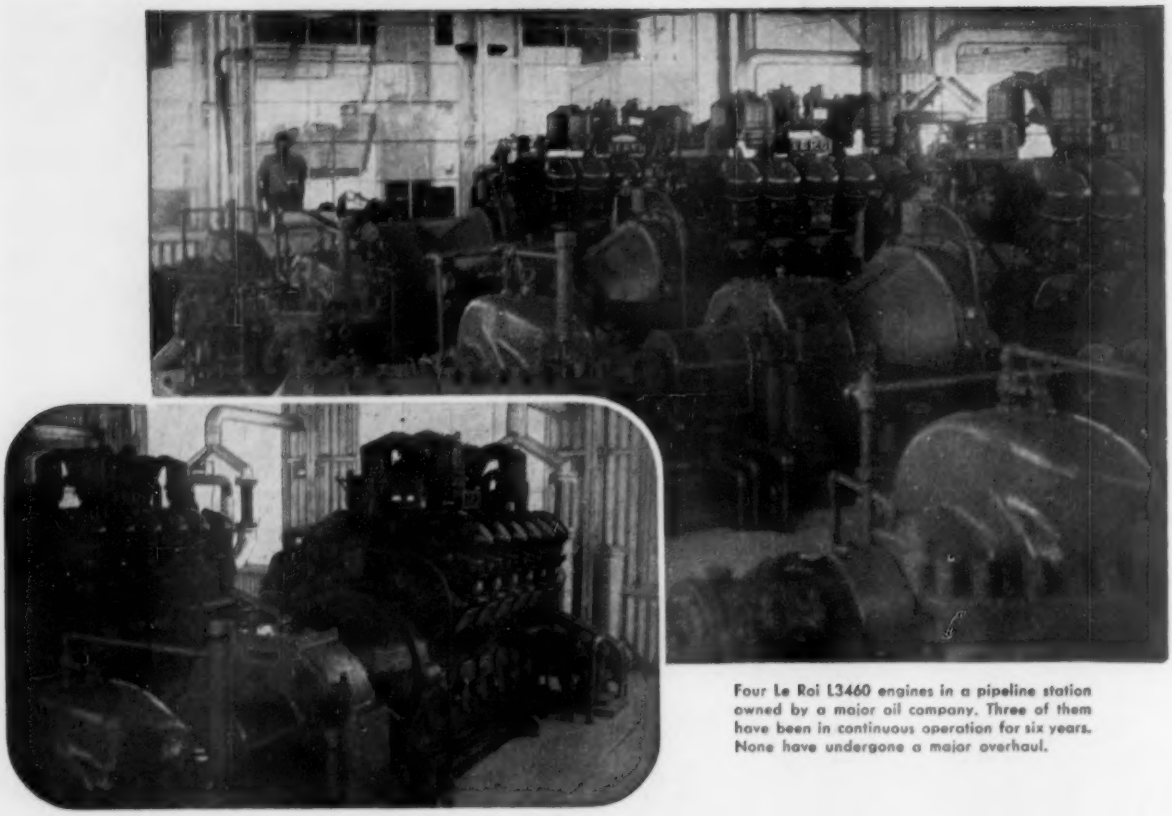
Components for Aircraft Engines

AMERICAN BOSCH

Small Electric Motors

Electric Windshield Wipers

Diesel Fuel Injection Equipment



Four Le Roi L3460 engines in a pipeline station owned by a major oil company. Three of them have been in continuous operation for six years. None have undergone a major overhaul.

Power-Packed Pipeline Station

. . . uses Le Roi L3460's to provide plenty of low-cost pumping power

Le Roi's L3460 with 600 max. hp. and its bigger brother, the L4000 with 655 max. hp., are ideal for pipeline service on many counts. Here's why:

Plenty of power with good fuel economy—These engines develop 600 and 655 max. hp. with rock-bottom fuel consumption, and can be run on natural gas, gasoline, or butane. Advanced design manifolding, low friction bearings, and low power loss to accessories, all contribute to unusual operating economy.

Long engine life—Perhaps the best proof of this statement is found in the trouble-free performance experienced by users in installations like the one shown above. Basically the L3460 and L4000 are compact, high-output engines designed with short stroke to give you greater horsepower and speed, without compromising engine life. And that's exactly what they do for you.

More comfortable operating conditions—Water-cooled exhaust manifold cuts down engine heat in operating areas, yet provides fast engine warm-up. The smooth, clean lines of these engines prevent dirt from collecting—that's why they are so easy to keep clean.

Compact V-12 design packs a lot of horsepower in a small space—to give you more horsepower per dollar. This, plus vibrationless performance, reduces foundation costs, simplifies installation.

We think that if you see an L3460 or L4000 in operation you'll agree that they provide the answer to low-cost pumping power. Have your supply house or Le Roi distributor show you one at work. Bulletins are available upon request—just write us.

P-140

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

Dow tank trucks provide fast, efficient service on diethylene glycol, triethylene, monoethanolamine, diethanolamine and other chemicals for treating natural gas.

you get

DOW DIETHYLENE GLYCOL WHEN AND WHERE YOU NEED IT

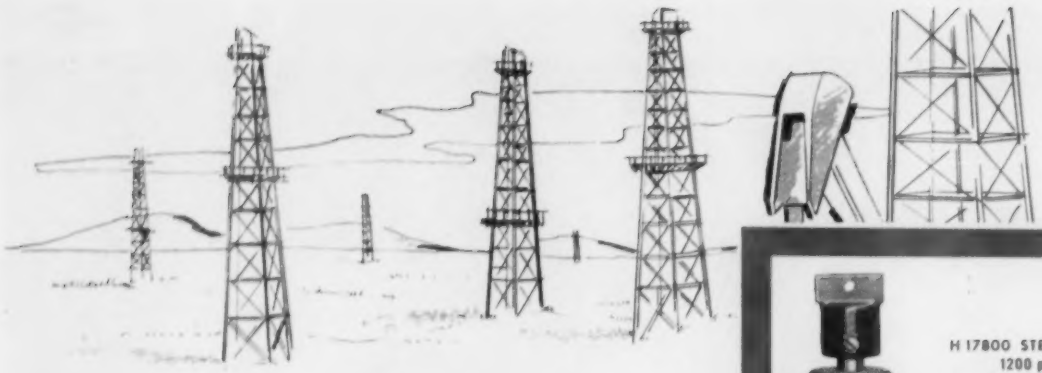
Fast Delivery to Well, Pipeline Substation or Storage Facility from Conveniently Located Dow Terminals

A big part of the gas dehydrating problem is solved by having an adequate supply of the right chemical at the right place whenever you need it. Diethylene glycol and other gas-treating chemicals may be needed anywhere along the line from well to consumer.

The many Dow shipping points are one reason why Dow service on diethylene glycol, triethylene glycol, monoethanolamine and diethanolamine is unexcelled. It permits you to keep your inventory at a minimum, and it assures rapid handling and prompt delivery of your order.

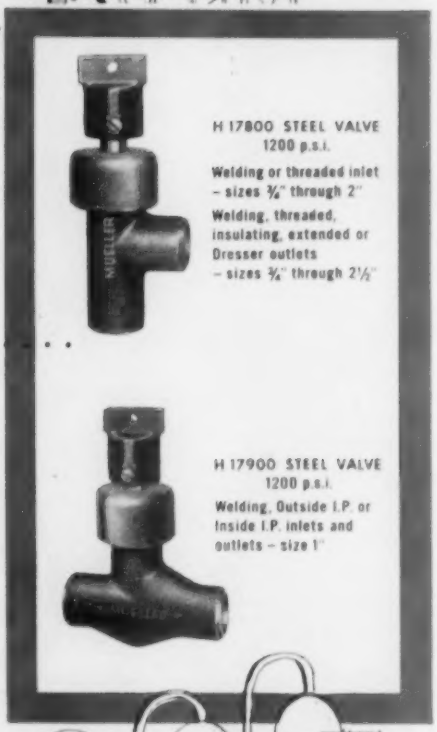
Ask about the many other advantages you get when you buy gas-treating chemicals direct from Dow. Contact your nearest Dow sales office or THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS DOW



MUELLER

High pressure steel valves



H 17800 STEEL VALVE
1200 p.s.i.
Welding or threaded inlet – sizes ¾" through 2"
Welding, threaded, insulating, extended or Dresser outlets – sizes ¾" through 2½"

H 17900 STEEL VALVE
1200 p.s.i.
Welding, Outside I.P. or Inside I.P. inlets and outlets – size 1"

INSTALLED UNDER PRESSURE.

The Mueller high pressure valve tee with welding inlet lets you tie into lines at any point without shut-off – and you have positive valve control at the connection. Tee is welded to line and put in service, under pressure, with the Mueller DH-2 Drilling Machine and H17145 Completion Machine. "O" ring seals around stem and between cap and body prevent leakage. If necessary, valve tee can be operated through a curb box from ground level.

RECONDITIONED UNDER PRESSURE.

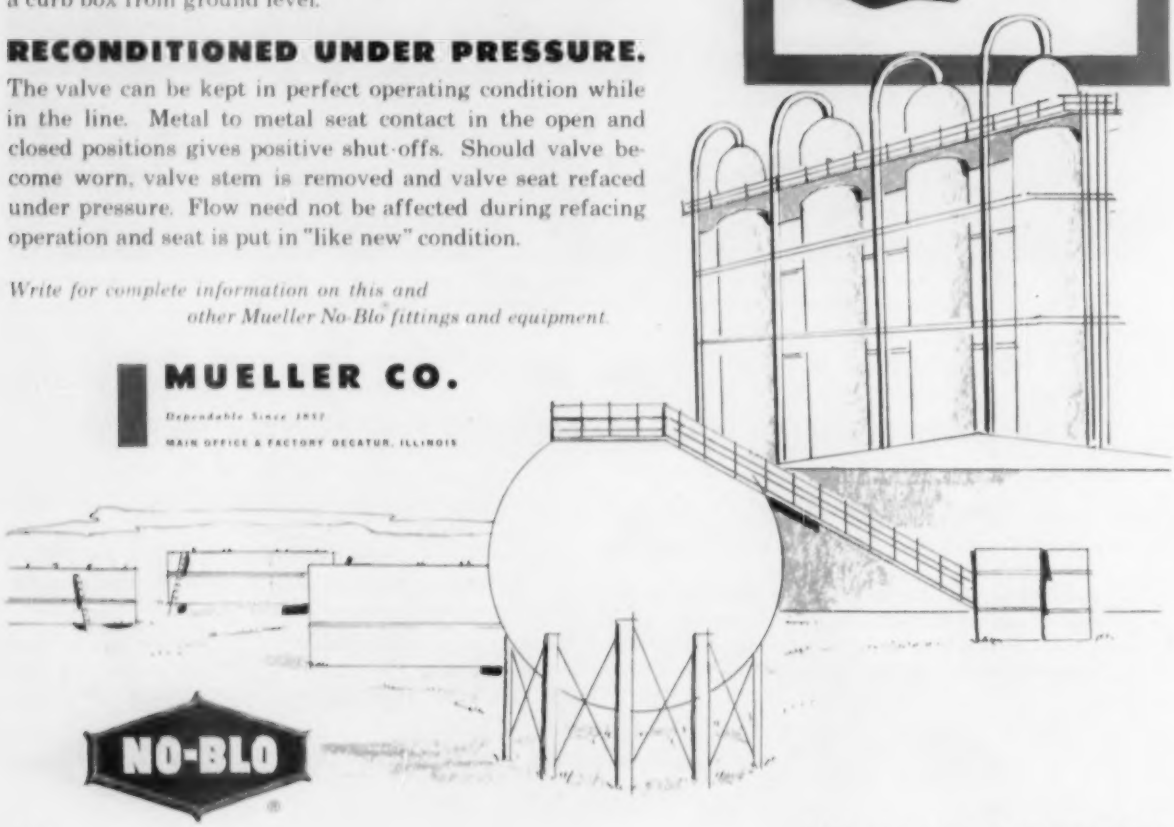
The valve can be kept in perfect operating condition while in the line. Metal to metal seat contact in the open and closed positions gives positive shut-offs. Should valve become worn, valve stem is removed and valve seat refaced under pressure. Flow need not be affected during refacing operation and seat is put in "like new" condition.

Write for complete information on this and other Mueller No-Blo fittings and equipment.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS



NO-BLO®

The best stainless tubing for a specific application cannot be identified by surface appearance alone. The answer is found in the grain structure. Because your guarantee of satisfactory service rests *inside* the metal, it is most important for the stainless tubing buyer to consider his supplier's methods of manufacture.

Corrosion resistance, which prevents product contamination, depends upon heat treatment. Heat treatment of stainless steel tubing for a specific end use may vary according to grade, size of tube and service requirements involved. For instance, the austenitic grades of stainless steel have optimum corrosion resistance only when all carbides have been dissolved and retained in solution by rapid cooling. At B&W, heat treatment is rigidly controlled, and every piece of stainless tubing is heat treated to provide optimum corrosion resistance when that property is required.

For virtually any application—pressure or mechanical—B&W can provide either seamless or welded stainless tubing in any number of grades, in a broad size range. Help is available through B&W Regional Sales Offices and a nationwide network of experienced tubing distributors. Mr. Tubes—your link to B&W—will be pleased to furnish detailed answers to your stainless tubing problems. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

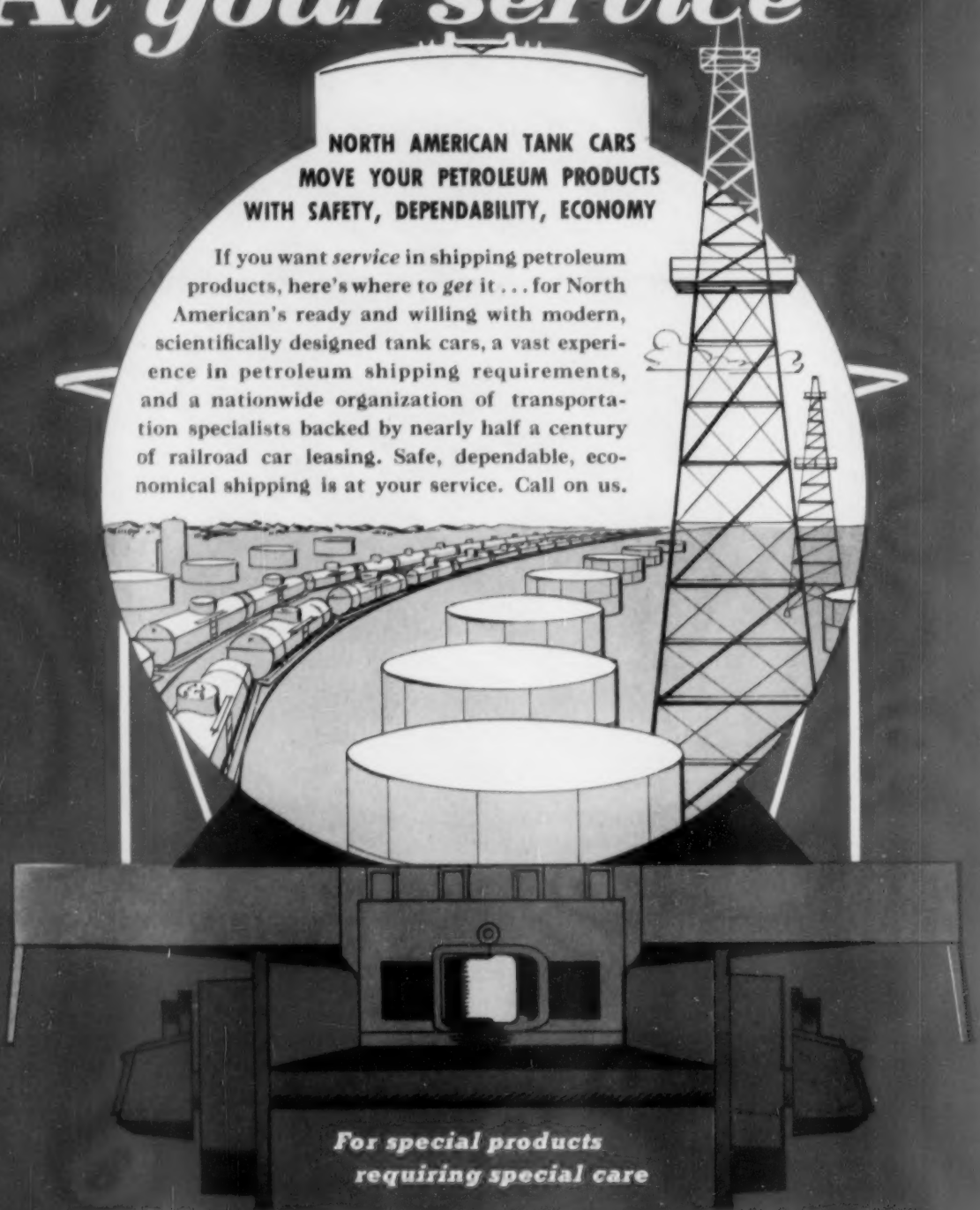
TA-6066-P

Seamless and welded tubular products, seamless welding fittings and flanges—in carbon, alloy and stainless steels

At your service

NORTH AMERICAN TANK CARS MOVE YOUR PETROLEUM PRODUCTS WITH SAFETY, DEPENDABILITY, ECONOMY

If you want *service* in shipping petroleum products, here's where to *get* it . . . for North American's ready and willing with modern, scientifically designed tank cars, a vast experience in petroleum shipping requirements, and a nationwide organization of transportation specialists backed by nearly half a century of railroad car leasing. Safe, dependable, economical shipping is at your service. Call on us.



For special products requiring special care

NORTH AMERICAN CAR CORPORATION

NORTH WESTERN REFRIGERATOR LINE COMPANY
MATHERS HUMANE STOCK TRANSPORTATION COMPANY

A NATIONWIDE ORGANIZATION WITH BRANCH OFFICES IN IMPORTANT MARKET CENTERS
231 South La Salle Street, Chicago 4, Illinois

Dallas · Fond du Lac · St. Paul · St. Louis · Tulsa · San Francisco · New York

Brewster N-45 Drawworks

OVER 45 YEARS EXPERIENCE

Small Rig Economy BIG RIG PERFORMANCE

The N-45 is packed with the extra features that make a drilling rig fast and profitable on work up to 6500 feet. From the big 40 x 18-inch drum back to the 450-horsepower transmission, every component has been designed to stand up under hardest service. Shafts are oversized . . . a double hydromatic brake eases heavy loads when going in and a two-speed air clutch transmission, plus a torque converter, gives the "just-right" combination of speed and power for every load when coming out.

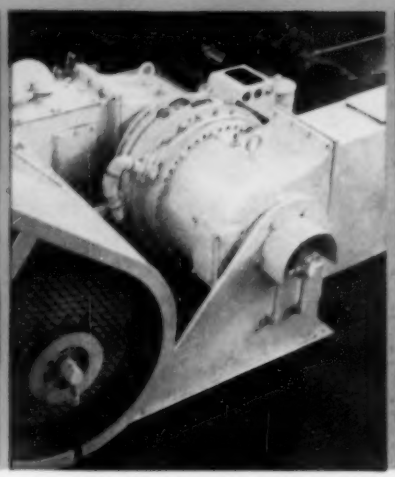
Flexible in design the N-45 can be ordered with single or twin engines . . . single or double drums . . . with hydromatic brake and pump drive. There is a model to fit every need.

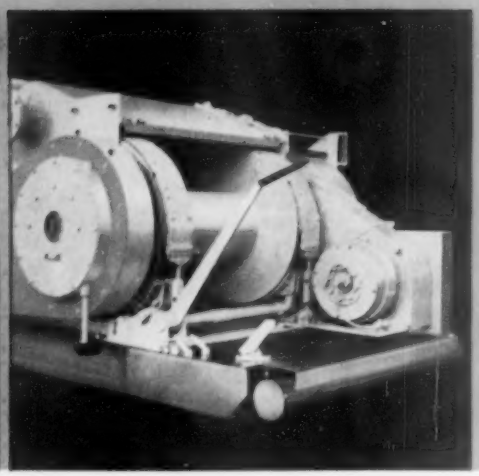
Before you buy . . . get all the facts on this top performing 450-horsepower drawworks. Ask your distributor or write direct to Brewster . . . today.

N-45 RESERVE POWER FEATURES

1. Torque converter drive 2. Two forward and one reverse speeds 3. Air clutch transmission 4. Big 40" x 18" Drum 5. Finger-tip controls 6. Optional sand reel 7. Double hydromatic brake 8. Big 42" brakes 9. Enclosed water-cooled drums 10. Optional pump drive

BREWSTER N-45





FULLY AIR-CONTROLLED

From the driller's station there is finger-tip air control of drum, transmission, pump and rotary clutches. The driller can shift from low to high without stopping the load. An emergency positive drum clutch assures continued operation should air supply be cut off.

TORQUE CONVERTER DRIVE

The amid-ships torque converter will handle one or two engines. Combined with the two-speed transmission it provides flexible shock-free power for every operation. Chain life is extended and engines stay up to maximum efficiency regardless of load.

OVERSIZED BRAKES

Brake rims are 42 x 8 inches and cooled by an enclosed circulating water system. Self-energizing with 327 degrees of contact they are fitted with an equalizer for even wear. Either brake band will hold should the other be disconnected or damaged. The brake mechanism can be adjusted without removing the drum guard.

THE BREWSTER COMPANY, INC.
Shreveport, Louisiana

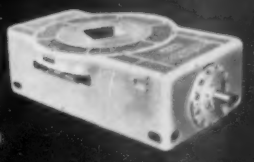
SUPPLY HOUSES

Howard Supply Company • Apex Equipment Company • Bovaird Supply Company Industrial Supply Company • Murray Brooks, Inc. • United Supply and Manufacturing Company • For Canada, Mexico and Export Sales: The Brewster Company

BREWSTER MATCHED DRILLING EQUIPMENT FOR THE N-45 DRAWWORKS

MODEL HT-100 HOOK BLOCK

4-SX OILBATH SWIVEL



RSH-18 ROTARY

SPECIFICATIONS BREWSTER N-45 DRAWWORKS

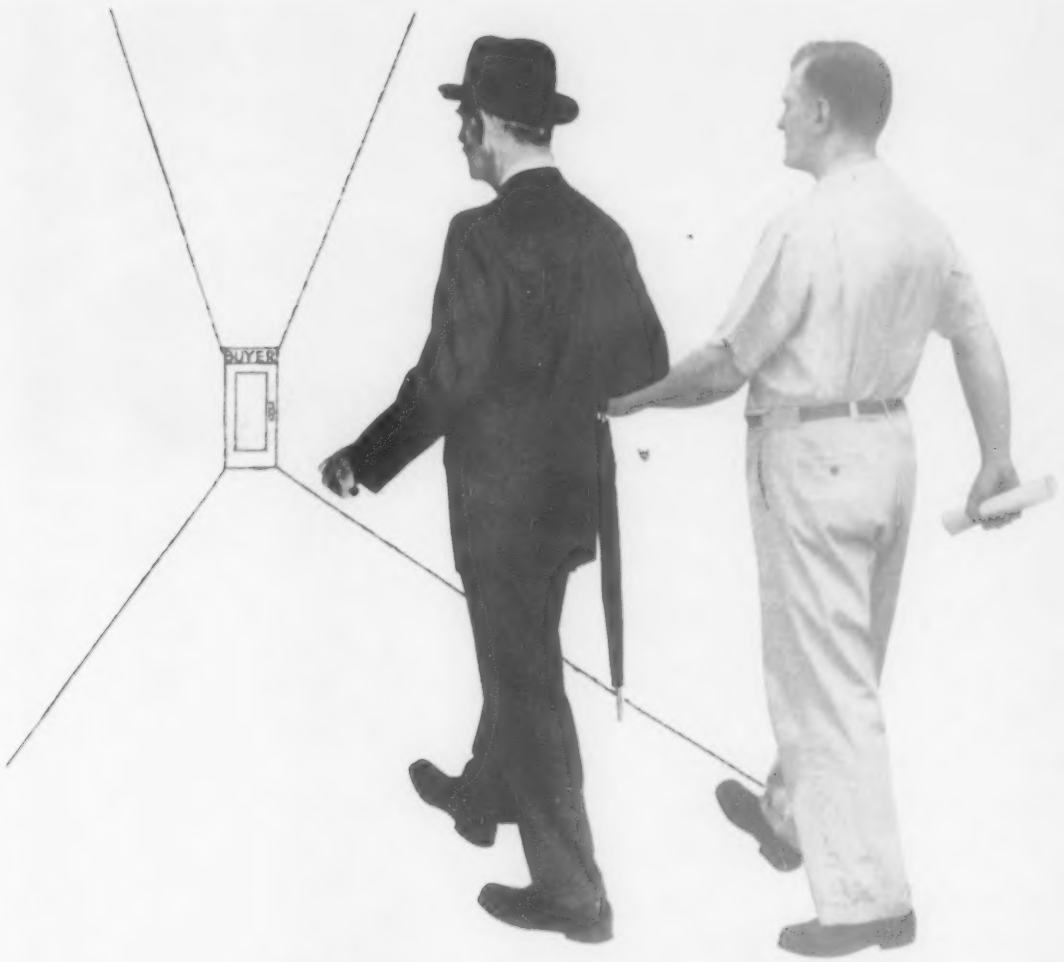
Recommended Horsepower	450 *	Forward Speeds	2
Diameter of Drum Flange	42"	Reverse Speeds	1
Diameter of Drum Spool	18"	Approx. Over-all Height	69¾"
Length of Drum Spool	40"	Approx. Width and Length of Skid	75" x 20'-0"
Size of Brake Lining	1" x 8"	Approx. Weight of Drawworks less Engine	22,000 lbs.

**With torque converter equipped engines — 350 HP with amidships T.C.*

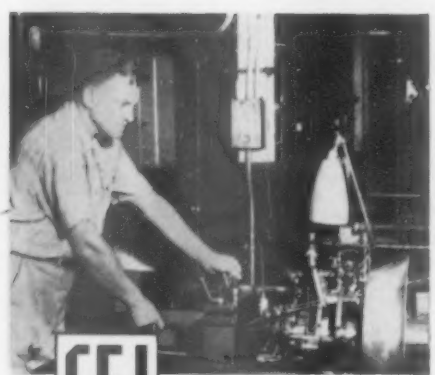
SPEED DIAGRAM

CONVERTER		PULL*		LINE SPEED *F.P.M.*		
OUTPUT–*R.P.M.*	EFFICIENCY–%	LOW	HIGH	LOW	HIGH	ROTARY SPEED
0	0	52,000	18,800	0	0	0
335	70	34,000	12,250	196	544	48
1330	70	7,500	3,150	808	2,245	190

*Based on 450 H.P. at 1800 R.P.M.



Your Wickwire Rope Distributor and our closer operator ...ready to help you



This closer operator—running a machine which forms our rope—is with your Wickwire Rope Distributor every time he makes a call.

True, he's physically in the mill, where he's carefully conducting this final fabricating operation. But, whenever your Wickwire Distributor makes a call, he has the full assurance that every foot of Wickwire Rope has been carefully assembled by skilled craftsmen . . . and that it will give you long, trouble-free service on your job.

It's just one more reason why your Wickwire Distributor knows he's got top-quality wire rope, slings and strand to sell . . . and that these products will serve you well.

CF&I WICKWIRE ROPE A CF&I PRODUCT

4085

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

AVONDALE

a service "tailor-made" for the Oil Man

Now . . . Avondale is equipped to serve you completely with a service tailored to your specific needs. At Avondale's Harvey Plant you will find a new OIL FIELD MACHINE SHOP and OIL TOOLS SERVICE. Here the most modern of machines and the most skilled workers are ready to supply a complete over-all service from start to finish on drill barge and oil rig repair, as well as new rig-up installation. The next time you need a job done . . . head for Avondale, crossroads of the oil country!

Prompt and Efficient Service . . . Day and Night

SHIP BUILDING • SHIP REPAIRING • FOUNDERS • PROPELLERS • STRUCTURAL STEEL

AVONDALE MARINE WAYS, INC. CABLE ADDRESS "AVONWAYS"

P. O. BOX 1030 • PHONE UNiversity 6-4561 • NEW ORLEANS 8, U. S. A.

How Cameron helps keep down the high cost of *SLUSH PUMP UPKEEP*

Cameron Shear-Relief Valves are available in 2" and 3" sizes; pressure setting ranges from 125 lbs. to 5000 lbs.

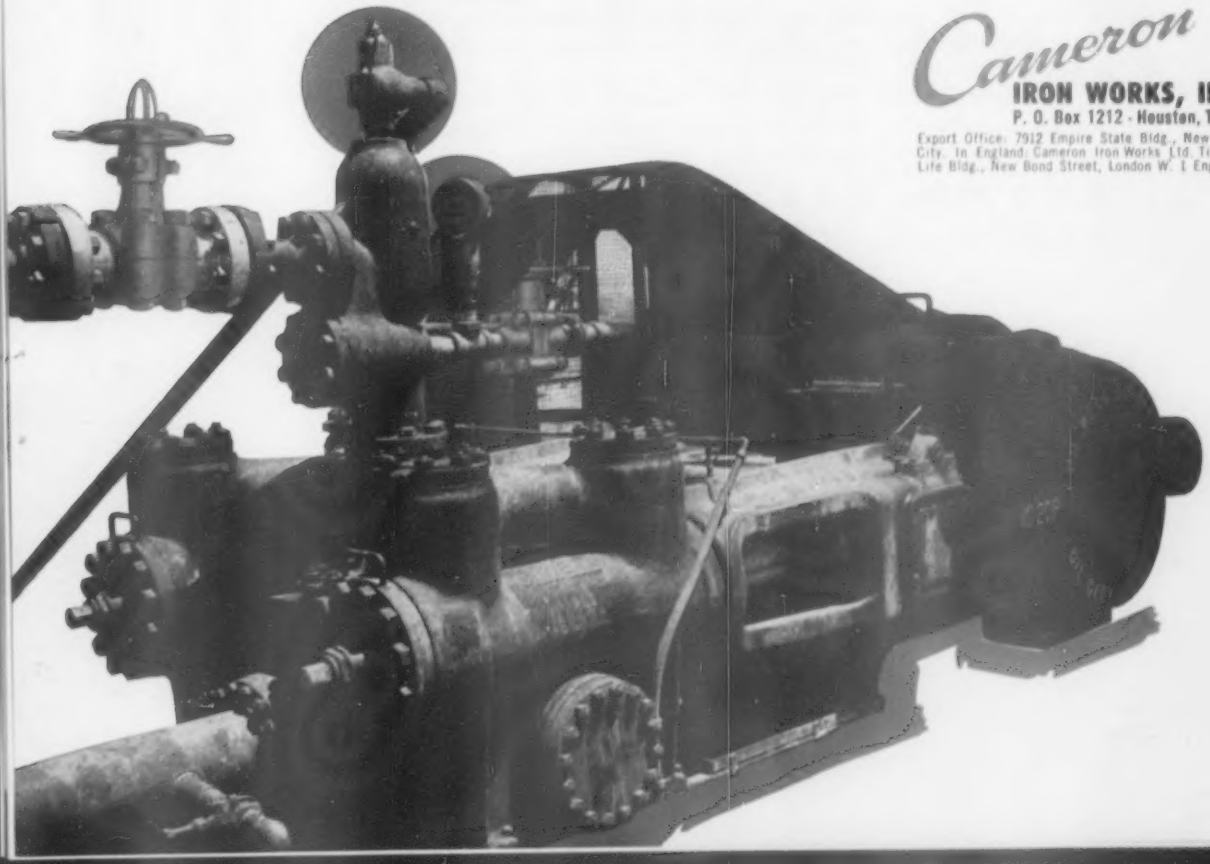
Cameron Mud Line Pressure Gauges are available in 2" size; pressure range from 1000 psi to 15,000 psi.

Slush pumps, mud manifolding, and rotary hoses are not guaranteed against excessive pressures. But you can prevent damage to them with these two Cameron safeguards: the Shear-Relief Valve and the Mud Line Pressure Gauge.

The Cameron Shear-Relief Valve may be set to open automatically at any predetermined line pressure. A common nail shears, the valve opens, and excessive pressure is relieved. No damage to anything but the nail! Money can't buy lower cost, more dependable insurance against damage to your mud system.

The Cameron Mud Line Pressure Gauge has made all other types of gauges obsolete for mud line service. Its movement is encased in a special light oil that damps pump pulsations and rig vibrations. A glance at its big steady dial tells you the exact pressure on the mud line. No guesswork.

To help keep drilling rig maintenance at a minimum, make sure that these proven Cameron safeguards are working for you.



Cameron
IRON WORKS, INC.
P. O. Box 1212 · Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd. Time & Life Bldg., New Bond Street, London W. 1 England.

No service compares with Brown Oil Tools
Twin Services·Production Tools and Fishing

Twin Services

Good service is something Americans expect and demand today. This is particularly true in the oil country where around-the-clock efficient service is the standard of the industry. In the highly competitive oil field service industry Brown Oil Tools stands out. Only Brown has the service organization capable of retrieving every tool lost out in the hole. The Brown Service Engineer is always at your call to take a personal and professional interest in the job he's going to help you with—and he's backed up by Brown's 25 years experience with production tools and fishing jobs.

BROWN OIL TOOLS, INC.
HOUSTON, TEXAS

BOT

REX

A.P.I. CHAINS

have balanced design for longest life

And that's one of the reasons why you get lowest cost per foot of hole. The strength of each chain part is balanced against that of the others for increased efficiency...longest life...lighter weight.

Balanced design means that all parts are equally strong...equally rugged. There are no "weak" parts to fail under load...to attract stresses and strains. Each part carries its full share of the load. The result...economical, long service...less down time!

Rex A.P.I. Chains alone have the famous 3-diameter pin...makes assembly and disassembly in the field easy. They have the famous Rex Unit-Link assembly that puts the links together to stay under toughest of drilling conditions.

For the most for your chain dollar, buy Rex® A.P.I. Chains...available at your supply store. For complete details, write Chain Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wisconsin.

CHAIN BELT COMPANY

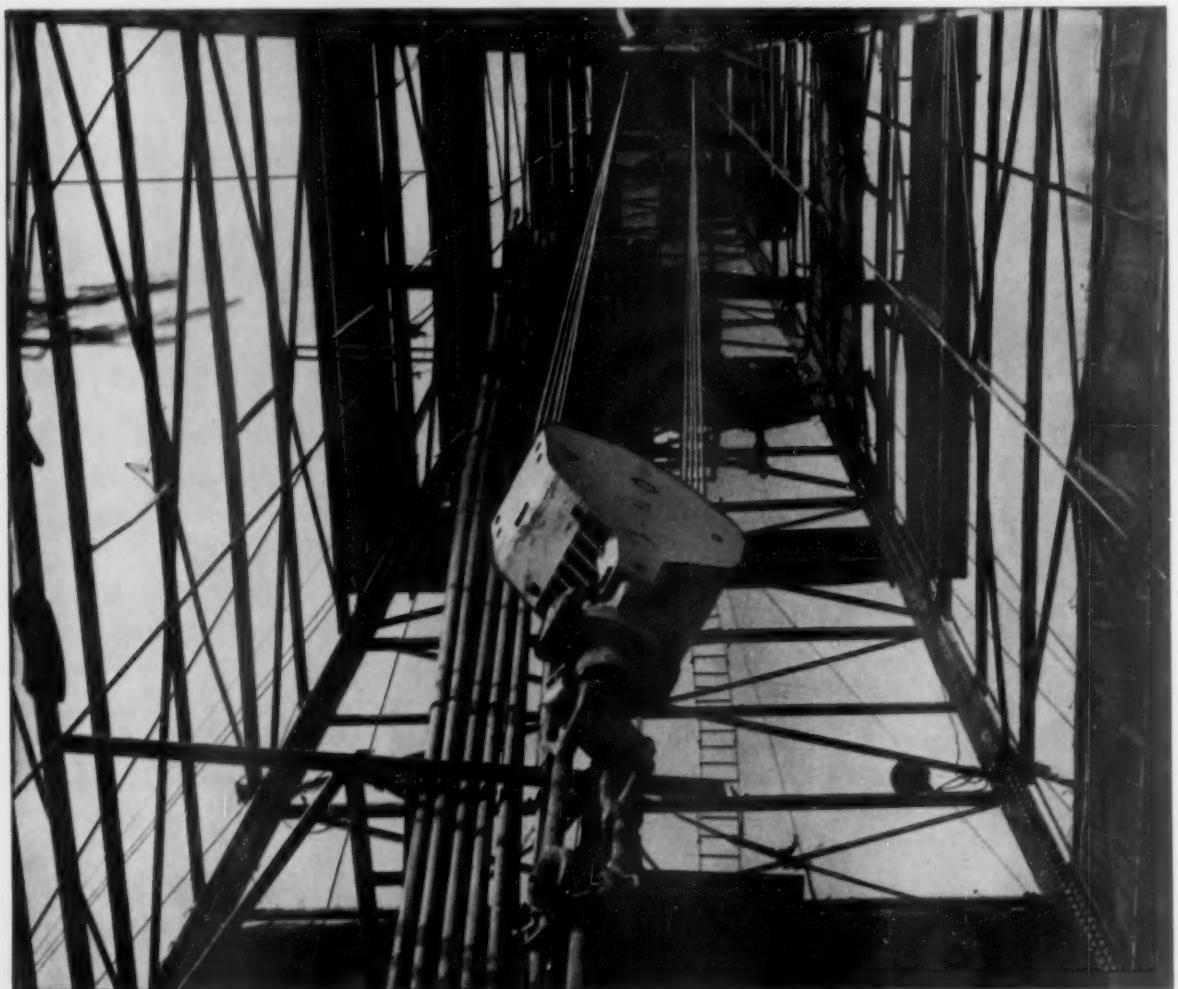
District Sales Offices in all Principal Cities

Designed for better ton-mile service

You can be sure of getting these essential drilling rope features when you buy Macwhyte's top quality rotary line—WHYTE STRAND. These ropes are *designed to meet your requirements*, made to give outstanding service and economy.

WHYTE STRAND rotary line is PREformed for flexibility and improved handling. It is internally Lubricated to resist corrosion and internal friction. This line is built for the severest service conditions. It will spool evenly on the drum and run smoothly through blocks with a minimum of whipping.

For every drilling need, you'll find a correct size and construction of Macwhyte line. Included in a thousand and one types and sizes of Macwhyte wire rope are Rotary Lines, Cable Tool Drilling Lines, Sand Lines, Winch Lines, Casing and Tubing Lines, for drilling, servicing, pipeline, or refinery equipment. Prompt shipment from stock.



MACWHYTE DRILLING LINES

MACWHYTE COMPANY, 2916 Fourteenth Avenue, Kenosha, Wisconsin

Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel, Wire Rope, and Wire Rope Assemblies.

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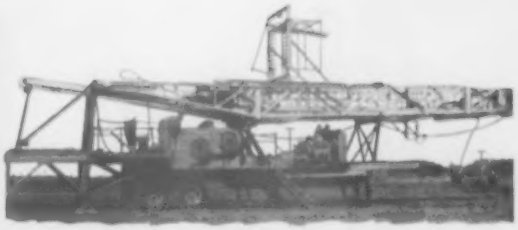
WHYTE STRAND bulletin 5425 available on request



Quick-Shifts at Full Throttle

in Failing's Stratmaster Rig

(in slim hole drilling, it's Torqmatic all the way)

"Drill of a Lifetime"—that's the way the George E. Failing Company describes its new Stratmaster portable slim hole rig for both deep exploration and shallow production.

Big feature of the Stratmaster is its Allison TORQMATIC DRIVE—the matched converter-transmission team that makes slim hole rigs of this type possible.

The TORQMATIC Converter protects engine and driveline components from shock loads, automatically balances engine power and load demand, takes it easy on drill pipe, chain and cable.

The TORQMATIC Transmission permits quick-shifts at full throttle *instantly*, lets the driller make faster round trips, speeds drill pipe changes.

Hundreds of companies operating thousands of drilling, servicing and fracturing units in the oil fields have rung up impressive performance records and big savings with Allison TORQMATIC DRIVES. If you'd build or buy better equipment, specify Allison TORQMATIC DRIVES. For full details write Allison Division of General Motors, Box 894R, Indianapolis 6, Indiana.

GM TORQMATIC

Allison

TORQMATIC DRIVES

This Easy Handling Hose Assures You Safer Drilling—at Lower Cost!

The Manhattan method of applying high-tensile steel cable wires under precisioned tension gives Ray-Man CBL Rotary Hose a degree of strength plus flexibility—and safety—never before equalled. Ray-Man CBL Rotary Hose also has unusual resistance to kinking or accidental crushing. This strength and flexibility are achieved without bulk. Therefore, it is easier to rig-up without accident . . . it holds steadier in the derrick without whipping—even under the high pressures of deep drilling. The result: Your drilling costs are cut because you get longer, trouble-free service.

Long-life and safer, easier handling are also insured by Manhattan's streamlined, built-in hose coupling. It is equipped with a special leak-proof "Lip-Lok" seal that tightens under pressure to prevent costly blow-outs. This hose coupling has no protruding lugs or flanges—nothing to cause fouling or damage on the job.

Bulletin #6743 describes other features which add up to the highest safety factor, longest life and lowest cost per foot drilled . . . "More Use per Dollar" . . . with Ray-Man CBL Rotary Hose.

RM-614

RM

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings • Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

Rockwell-Nordstrom Hypreseal valves cut costs on 1500 psi header

THEY GOT A BETTER HEADER

To make sure they got the most dependable flow control (yet with an eye to economy) the production-management team above all agreed on Rockwell-Nordstrom valves. Here's why:

Rockwell-Nordstrom valves are *lubricant sealed* for really positive shut-off. Lubricant also jacks the plug for *instant*, quarter-turn operation even when the valve has been open or closed for months. And since there are no exposed seats to cut away and because lubricant practically eliminates maintenance—they cost less to use and stay in service longer than any other valve.

Rockwell-Nordstrom valves are available at leading oil field suppliers everywhere. You'll pay no more for them, often less, than ordinary valves. No matter where you use them, they give you better performance at lower cost. Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Limited.

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

40th YEAR *of lubricated plug valve leadership*

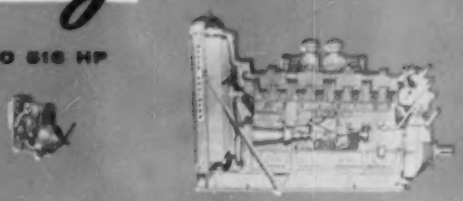
IT'S Allis-Chalmers ENGINES for *any* Power Need

any FUEL

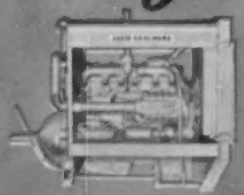
DIESEL . . . GASOLINE
LP GAS . . . NATURAL GAS

any SIZE

9 TO 816 HP



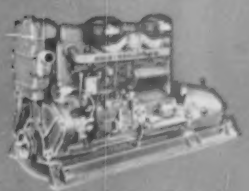
any TYPE



OPEN OR ENCLOSED POWER UNITS

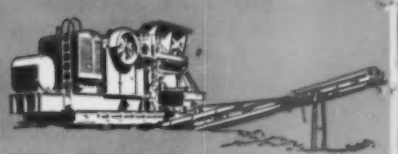
GENERATOR SETS

FAN-TO-FLYWHEEL ENGINES



MARINE ENGINES

any USE



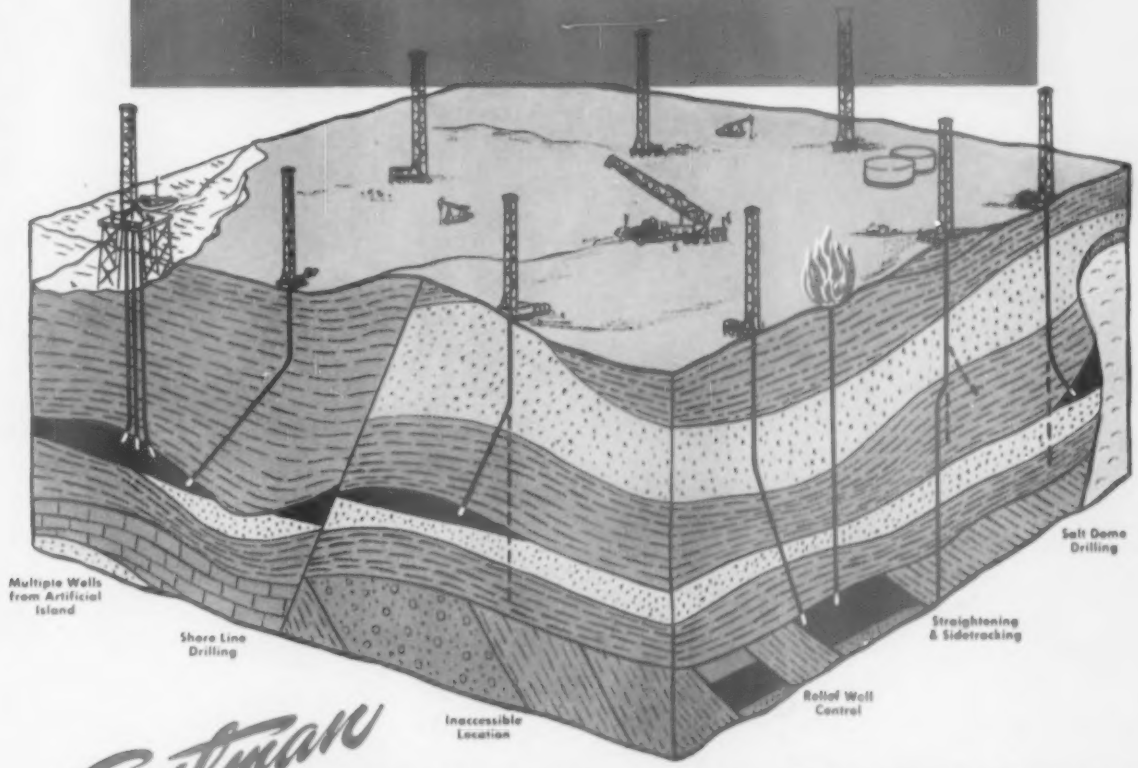
Make your Allis-Chalmers Engine Dealer your main source of power for all your engine needs. He can supply a wide range of engines for any fuel — gasoline, diesel, LP gas, natural gas — for any use . . . stationary or mobile-power units, fan-to-flywheel engines, generating sets or marine engines. Each has the high-efficiency, long-life characteristics necessary for continuous as well as stand-by service. With a high degree of interchangeability of parts, you can use a different type of engine for each application and yet maintain a small stock of parts.

Write for bulletins or see your Allis-Chalmers Engine Dealer for more information.

ALLIS-CHALMERS, BUDA DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS A-C ALLIS-CHALMERS

DIRECTIONAL DRILLING...?
SIDETRACKING...?
OIL WELL SURVEYING...?



Eastman SERVICES ARE SUPERIOR!

THESE ARE *THE FACTS*:—

1. Over twenty-five years of continuous service provides you the best of our experience obtained from all major oil fields throughout the world.

2. We are originators of controlled directional drilling and sidetracking services.

3. We are pioneers of oil well bore hole surveying.

4. First to offer free engineering consultation service, job planning and proposals on directional drilling and sidetracking problems.

5. The only service company manufacturing its own complete line of tools and instruments for directional drilling and sub-surface surveying.

6. Constant supervision of all jobs by area superintendents.

7. The only directional drilling company with a full time research and development department devoting time exclusively to directional drilling and surveying problems, the benefits from which accrue to the oil industry in general.

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SETTING
NEW STANDARDS
OF PERFORMANCE...

Another
LUNKENHEIMER
FIRST!

THE
LQ600
VALVE

FIG. LQ600-200
200 lb. S.P.—400 lb. W.O.G.
550° F.

FIG. LQ600-150
150 lb. S.P.—300 lb. W.O.G.

¼ to 2 inches

Thousands of these valves have served for as long as five years without replacement, regrinding, maintenance, or leakage—even on the most severe services. Their patented Brinalloy* seats and discs are more resistant to wear and corrosion than 500 Brinell Stainless Steel . . . even outlast case-hardened Stainless Steel exceeding 1000 Brinell. LQ600 Valves practically eliminate maintenance costs!

*Patented Alloy—T. M. Reg.

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THE LUNKENHEIMER CO., CINCINNATI 14, OHIO

LUNKENHEIMER®
THE ONE Great NAME IN VALVES

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NORDBERG

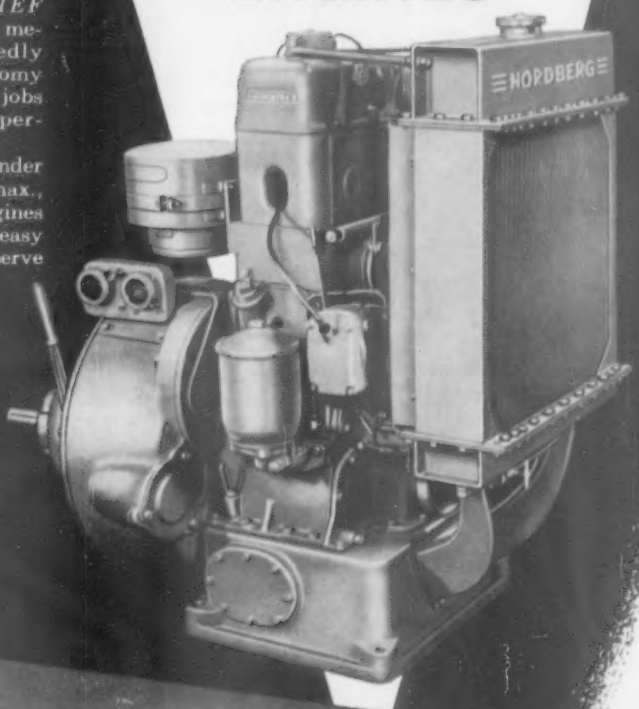
POWER CHIEF®

OIL FIELD ENGINES

FOR PRODUCTION PUMPING

Nordberg *POWER CHIEF* Gas Engines are low cost, medium speed units, ruggedly built for maximum economy on production pumping jobs where 'round-the-clock performance is a must.

Available in 1 and 2-cylinder sizes, up to 36 hp max., *POWER CHIEF* Gas Engines are simple to install and easy to maintain—ready to serve you 24 hours a day.



FOR RIG LIGHTING

More and more rigs are being lighted by Nordberg *POWER CHIEF* Diesel Generator Sets . . . because these sturdy units stand the gaff of continuous service, night after night, without constant attention and maintenance.

Built in 1, 2 and 3-cylinder sizes, from 10 to 45 hp, 6 to 30 kw—*POWER CHIEF* engines are available with special vibration-proof mounting for rig installation.

NORDBERG MFG. CO.

Milwaukee, Wisconsin

SEND FOR NEW BULLETIN

NORDBERG

DIESEL • DUAFUEL® AND SPARK IGNITION GAS ENGINES

Available at your local Supply Store or contact these Authorized Distributors:

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KANSAS—Mead Engine & Welding Works, Sterling, Kansas
OKLAHOMA—Cornelison Engine Maintenance Co. Inc., Seminole, Oklahoma
HOUSTON & GULF COAST—Diesel Engine & Equip. Service Co., Houston, Texas
LOUISIANA & MISSISSIPPI—Rogers Diesel Engineering Co., New Orleans, La.
WILLISTON—Tractor & Equip. Co., Sydney, Montana
COLORADO—JULESBURG—Mead Engine & Welding Works, Sterling, Colorado
SOUTHERN CALIFORNIA—In-Mar Co., Wilmington, California

NORDBERG MFG. CO., Milwaukee, Wisconsin OG

Send New Bulletin 239A covering *POWER CHIEF* Oil Field Engines to:

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City..... Zone..... State.....

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LOSING CIRCULATION

in the pay zone?

best thing for it is...

"FORMASEAL"

There when you need it...

Gone when you don't!

That's the story of FORMASEAL in a few words. It forms a composite mat on the walls of the hole and plasters off porous formations that drink up mud . . . while drilling goes on. On completion, crude oil dissolves it . . . and lets the well come on production.

Costs of rig time, lost fluid and emergency treatment mount up quickly when circulation is lost. FORMASEAL goes to work immediately, building up a tenacious plastic barrier unlike other lost circulation materials . . . and it costs less than most other lost circulation additives.

With oil base mud or crude oil, FORMASEAL may be added directly to the mud stream while circulating and prior to entering an anticipated lost circulation area. With water base or oil emulsion muds, FORMASEAL's fast action gives good results when a thick pill (up to 1 sack/bbl.) is spotted opposite the zone of loss.

No special application techniques are required. FORMASEAL is added through the hopper or directly into the suction pit. Its stability permits storage in any convenient location with complete freedom from bacterial action.

Hundreds of field examples have conclusively proven that FORMASEAL not only stopped lost circulation, but on completion insured maximum productivity with no permeability damage. For complete details on this superior lower cost lost circulation material, contact your OBI representative or write Oil Base, Inc., 130 Oris Street, Compton, Calif.

OB PRODUCTS

OIL BASE, INC.

PLANTS IN: Houston • Odessa • Duncan • Bakersfield • Compton
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Specially Designed for
• Offshore Operations
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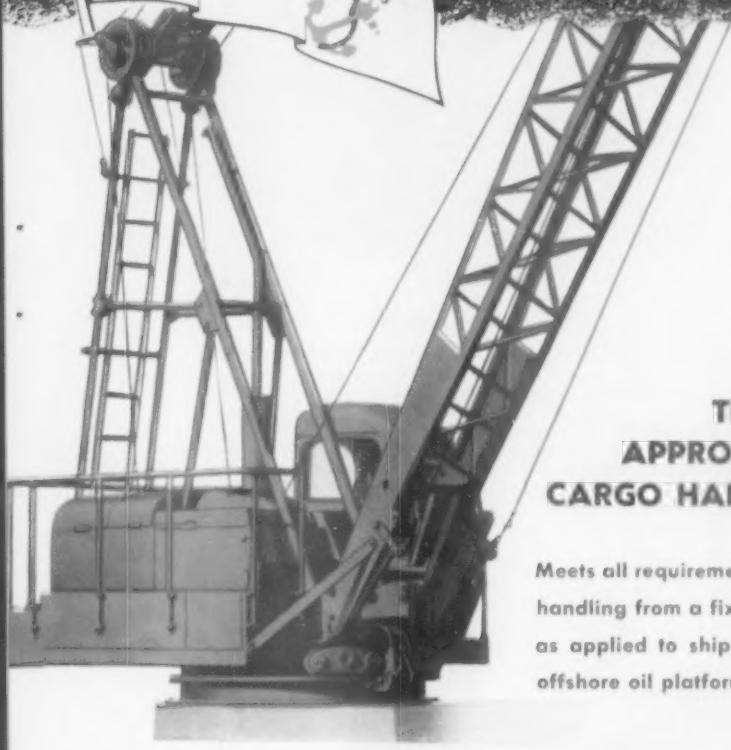
UNIT MARINER



Designed to operate from a fixed mounting, the UNIT MARINER delivers dependable and economical performance aboard offshore equipment. Cargo is conveniently transferred from tender to platform.

THE NEW APPROACH TO CARGO HANDLING!

Meets all requirements for cargo handling from a fixed mounting as applied to ships, barges, or offshore oil platforms.

Features incorporated in the MARINER design include: One-piece cast gear case — a protection against salt spray • Self-aligning centerpost trunnion • Turntable load rollers plus replaceable hook shoes • Large diameter roller path • Worm type independent boom hoist • Large diameter swing brake • Disc type clutches • Straight-in-line engine mounting with torque converter plus many other important features. The LIFT and CONTROL ability of the MARINER permits loading and unloading with speed and accuracy. The full range vision safety cab enables the operator to see what he is doing at all times. Here's a machine constructed for your type of Cargo handling. Get the facts.

Write for: Bulletin MO-200 for Offshore Platforms
MS-200 for Ships and Barges

BEFORE

AFTER

The net results of converting from old type rigging: Speeds up cargo handling — reduces idle port time — cuts maintenance cost. These self-contained MARINERS operate independently of ship's power.

UNIT CRANE & SHOVEL CORP. UNIT MILWAUKEE WISCONSIN

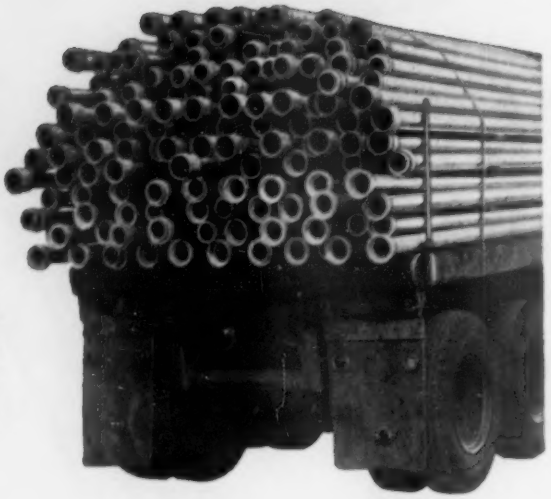
UNIT CRANE & SHOVEL CORPORATION

6327 WEST BURNHAM STREET • MILWAUKEE 14, WISCONSIN, U. S. A.

SHOVELS • DRAGLINES • CLAMSHELLS • CRANES • TRENCHOES • MAGNETS

AMAZING ECONOMIES

WITH KAISER ALUMINUM PIPE!



FULL MILE OF PIPE CARRIED ON ONE TRUCK! The truck shown has a maximum load limit of 18,000 pounds—yet is loaded with 176 lengths of 30-foot, 4-inch Kaiser Aluminum Petroleum Pipe! Total pipe weight is less than 5,500 pounds—well within the load limit. Total pipe footage—one full mile! A similar length of steel line pipe would require more than three trucks. *Kaiser Aluminum pipe cuts the cost of hauling by at least two-thirds!*

10 TIMES EASIER TO HANDLE THAN STEEL PIPE! As shown below, 30 feet of 4-inch Kaiser Aluminum petroleum pipe is *easily* handled by only one man—because it's more than 10 times lighter than steel pipe. But 25 feet of 4-inch steel pipe is a heavy load for four men. Light weight of Kaiser Aluminum pipe results in *savings up to $84.35 per mile for loading, stringing, and pickup!*

CONNECTS 14 TIMES FASTER THAN STEEL PIPE! Only one or two men with light tools are needed to connect Kaiser Aluminum 4-inch petroleum pipe, using new quick connecting aluminum couplers. With T&C steel pipe, three or four men with heavy tools are required. *Savings for connecting and disconnecting alone are as much as $135.48 per mile!*

Obviously, the savings possible with Kaiser Aluminum petroleum pipe are enormous! So see your supplier now. He stocks Kaiser Aluminum petroleum pipe in 30-foot lengths of 2, 3, and 4 inch diameters, with cladded inside surfaces to provide increased resistance to corrosion. He also has couplers and other fittings to complete your system.

For further information on the pipe, fittings and tools, contact the Kaiser Aluminum sales office listed in your telephone directory.* Kaiser Aluminum & Chemical Sales, Inc. *General Sales Office,* Palmolive Building, Chicago 11, Illinois; *Executive Office,* Kaiser Building, Oakland 12, California.

* **Information may also be obtained from the following suppliers:**

REPUBLIC SUPPLY COMPANY
Republic Building (Home Office)
Oklahoma City, Oklahoma

DUNIGAN TOOL & SUPPLY CO.
1534 South Treadaway
(Home Office)
Abilene, Texas

Kaiser Aluminum

WORKING for YOU

—18 stores—with men and supplies—located to best serve you in Texas and Louisiana.

—'Round the clock' service ready to meet your needs with

"WHAT YOU WANT—
WHEN YOU WANT IT."

WILSON SUPPLY CO

1301 CONTI ST., HOUSTON, TEXAS

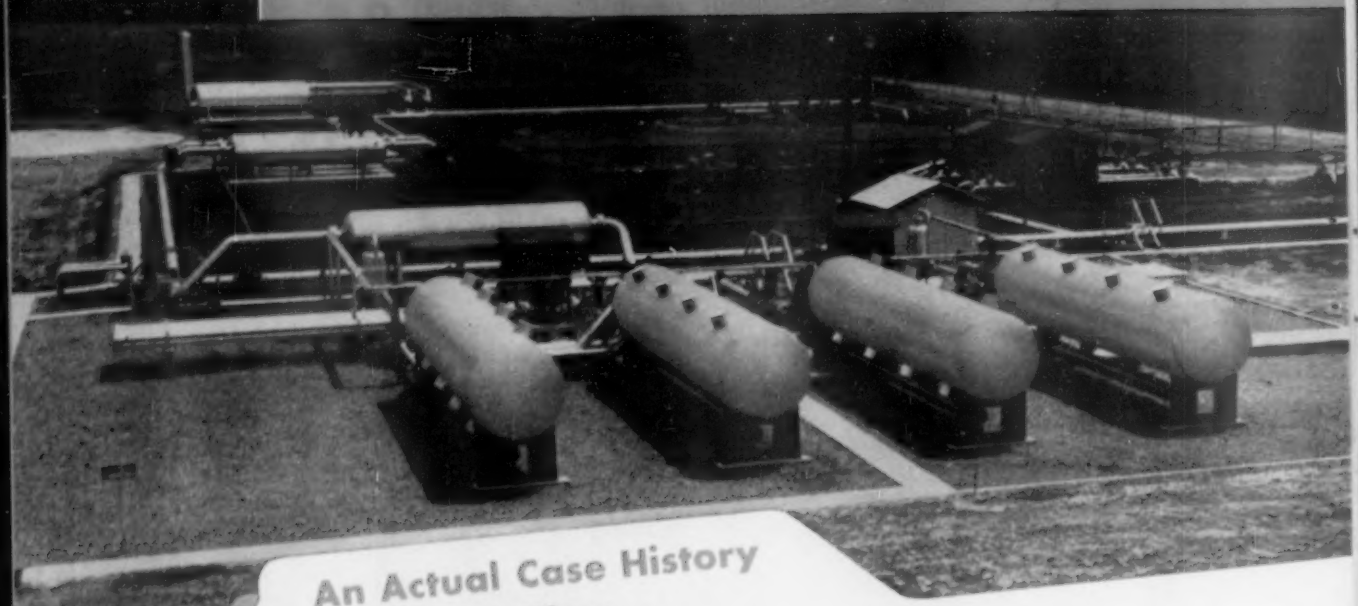
BRANCH STORES

TEXAS: Alice, Corpus Christi, Victoria, McAllen, Bay City, Columbus, Barbers Hill, Liberty, Beaumont, Kilgore, Sherman, Odessa. LOUISIANA: Lake Charles, New Iberia, Houma, Harvey, Shreveport.

SALES OFFICES

DALLAS SHREVEPORT SAN ANTONIO
TULSA NEW ORLEANS LAKE CHARLES
CORPUS CHRISTI MIDLAND

BS&B Dry Type Dehydrators Give Union Oil & Gas of Louisiana Up To 180 MMSCF of Dry Gas Sales Daily!



An Actual Case History From Our Files:

PROBLEM:

Continued gas sales by Union Oil & Gas of Louisiana to a pipeline company were in jeopardy because of undesirable moisture content in the gas. Suitable dehydration equipment was needed to continue this sale. Production was from Lake Arthur Field near Roanoke, La.

SOLUTION:

A BS&B Model DDH Dry Type Dehydrator with a rated capacity of 150 MMSCFD, and a 150 MMSCFD inlet scrubber, were installed. BS&B Automatic Controls were used throughout.

RESULT:

The operator is now delivering pipeline specification gas to the pipeline company at flow rates up to 180 MMSCFD. Pipeline company is pleased and has noted increase in existing capacity due to removal of water vapor. When asked about the operation of the equipment, the operator said, "It operates itself."

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

P.O. Box 1714

Oil & Gas Equipment Div., Dept. 1-A10

Oklahoma City, Oklahoma

Rugged Chicago Pneumatic Three Cone Rock Bits are designed to afford deep penetrating action with every turn of the drill stem. Their fast cutting speed enables you to drill more feet a day. They're available in seven different types from soft to exceedingly hard and abrasive formations. *Oil Tool Division, Chicago Pneumatic Tool Company, 5000 U. S. Highway 81 South, Fort Worth, Texas.*

Chicago Pneumatic

GENERAL OFFICES: 8 East 44th Street, New York 17, N. Y.
IN CANADA: 10103 81st Ave., So. Edmonton, Alberta, Canada
IN MEXICO: D.R. Rosas Morena No. 41, Mexico City, D. F., Mexico
PETROLEUM MACHINERY CORPORATION: 30 Rockefeller Plaza, New York 20, N. Y. (Export Agent, exclusive of Mexico and Canada)

THREE CONE BITS • REAMING BITS • REAMERS • DRILL COLLARS • TOOL JOINTS • SUBS • JUNK BASKETS

ANNOUNCING

2 GREAT PRODUCTS TO SAVE HIM

OIC PLUG VALVES & AMERICAN METER

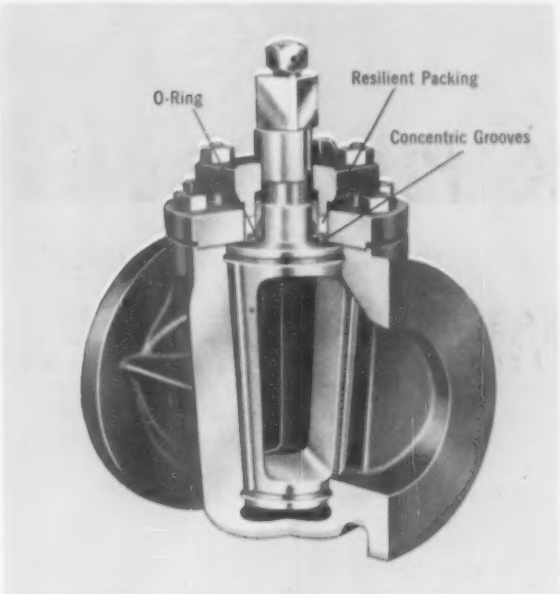
An unbeatable gas flow-control and measurement combination

OIC's exclusive, triple-seal lubricated plug valve design is a perfect complement to the dependable quality of American Meter's top line of measurement and control equipment.

OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

JOIN FORCES

MAINTENANCE TROUBLES



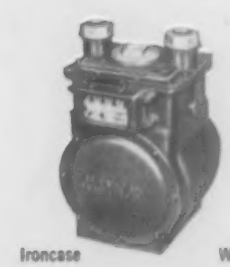
Exclusive OIC triple seal ends shank and gland leaks . . . retains adjustment

Concentric grooves form a *labyrinth seal.* Gland liner also retains an *O-ring*—a second seal. *Resilient packing* forms a third seal, is completely isolated from all moving parts.

These three seals act separately from the valve's lubrication system to prevent gland and shank leakage. Lubrication in grooving surrounding body ports, plus lube film on body and plug surface provides a positive seal between plug and body.

Maintenance-free metering to fit your needs

Make your choice from American Meter, the only manufacturer of a complete line of precision measurement and control equipment for the gas, oil and chemical industries. And now American Meter serves you even more completely, offering you the OIC line of lubricated plug valves stocked at strategic locations for prompt delivery.


Ironcase

Welded Steelcase

Aluminumcase

Tinned Steelcase

AMERICAN® METER COMPANY
INCORPORATED 1887 ESTABLISHED 1833

GENERAL SALES OFFICE Somerton, Philadelphia 16, Penna
Albany · Alhambra · Atlanta · Baltimore · Birmingham
Boston · Chicago · Dallas · Denver · Erie · Houston
Kansas City · Los Angeles · Minneapolis · New York
Omaha · Pittsburgh · San Francisco · Seattle · Tulsa · Wynnewood
IN CANADA: Canadian Meter Company, Ltd., Milton, Ontario
Calgary · Edmonton · Regina

SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Provers • Appraisals

announcing.. BJ RED TOP CENTRALIZERS

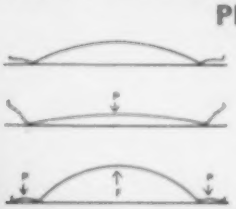
the first really NEW centralizer in years...

Now, Byron Jackson brings you the most advanced centralizer on the market. The exclusive new pre-stressed spring design gives Red Top Centralizers maximum centering force without resorting to heavy "high-bow" springs. Centering force without bulky springs gives better mud and cement circulation. Specify Red Top Centralizers on your next casing job—and your crew will give you a faster, better cement job.

NEW	pre-stressed springs give maximum centering force
NEW	ease of mud or cement circulation . . . no heavy or "high-bow" springs to obstruct flow
NEW	smaller diameter allows easy passage through spider and rotary table — eliminates banding and cutting
NEW	rivetless, weldless construction...no uneven stress pattern or brittleness

Send for new BJ Centralizer Bulletin

HERE'S HOW BJ's EXCLUSIVE PRE-STRESSING WORKS:



1. Spring used in a Red Top Centralizer at rest.
2. If pressure (P) is applied the ends of the spring will rise.
3. Conversely, if pressure (P) is applied to the ends, the spring is "pre-stressed" and exerts force (F) outward.

watch BJ RED for the NEWEST!

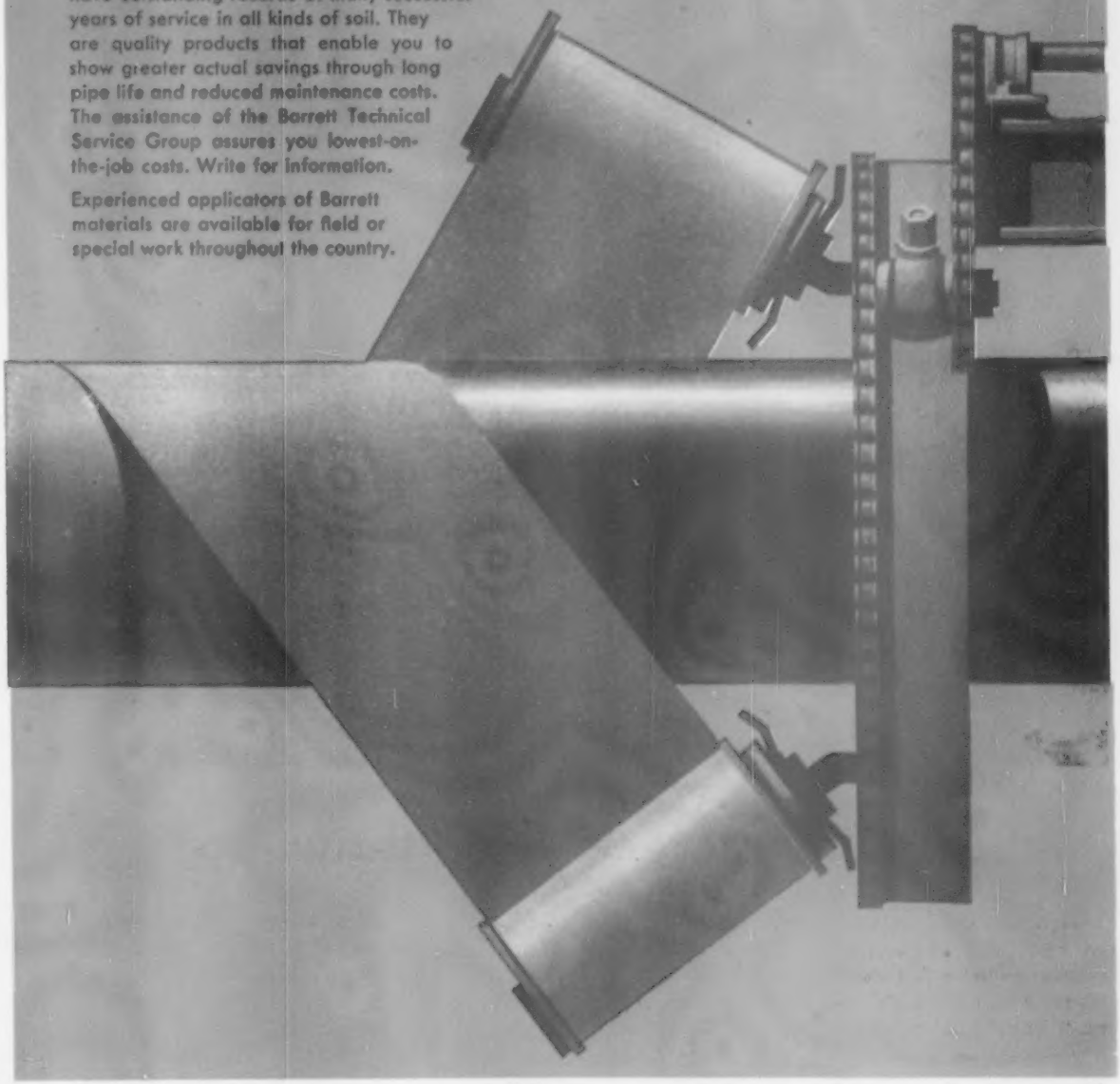
EXPORT ADDRESS: 580 Fifth Ave., Suite 510, New York 36, N.Y.
Sales Engineers in all principal oil fields

BYRON JACKSON TOOLS
INCORPORATED
A SUBSIDIARY OF BORG-WARNER CORPORATION
P.O. Box 2017A, Terminal Annex, Los Angeles 54, Calif.
Offices in Houston, Fort Worth, Denver and New York

WRAPPING IT UP

Barrett Protective Coatings wrap up your pipe protection problem at lowest cost. Barrett Primer, Coal-Tar Enamel and Pipeline Felt have outstanding records of many successful years of service in all kinds of soil. They are quality products that enable you to show greater actual savings through long pipe life and reduced maintenance costs. The assistance of the Barrett Technical Service Group assures you lowest-on-the-job costs. Write for information.

Experienced applicators of Barrett materials are available for field or special work throughout the country.



CHEMICAL PROGRESS WEEK-APRIL 23-28

Barrett®

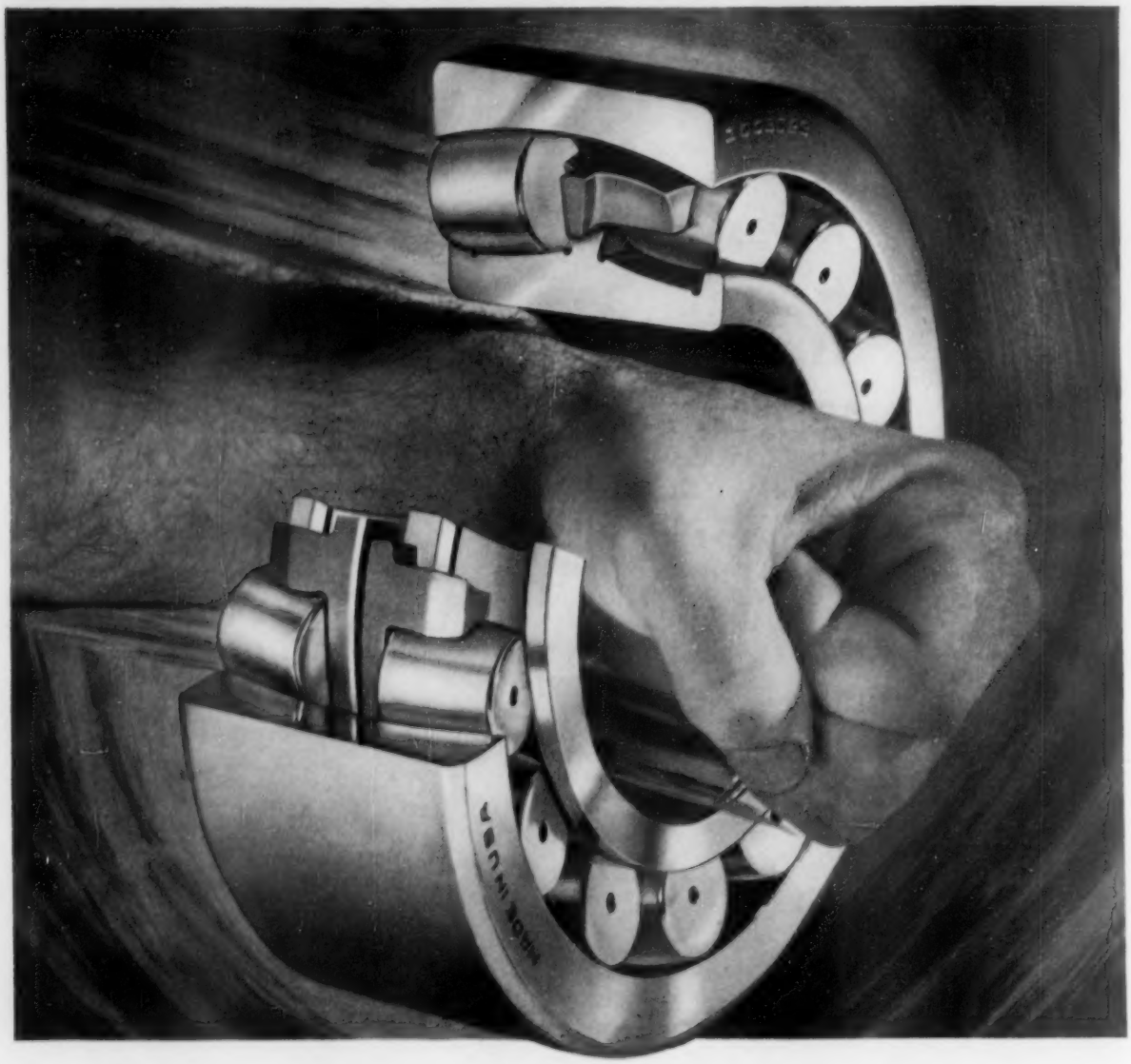
PROTECTIVE COATINGS

BARRETT DIVISION, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N. Y. In Canada: The Barrett Company, Ltd., 5551 St. Hubert Street, Montreal, P. Q.

OVER 100 YEARS OF EXPERIENCE

Allied Chemical

TORRINGTON *SPHERICAL ROLLER* BEARINGS



This bearing can take thrust, too!

Design is the secret. TORRINGTON Spherical Roller Bearings are made with an integral center flange on the inner race. This assures *positive radial stability and accurate positioning of rollers* wherever high radial load and heavy thrust are encountered under conditions of misalignment.

From crushers to cranes, power shovels to pulverizers, you get long, maintenance-free operation, better performance in your equipment, more value from your bearing dollar when you specify these rugged dependable bearings.

Prove to yourself that TORRINGTON design does make a difference. Next time specify TORRINGTON Spherical Roller Bearings. They're available with either straight or tapered bore, for shaft or adapter mounting.

THE TORRINGTON COMPANY

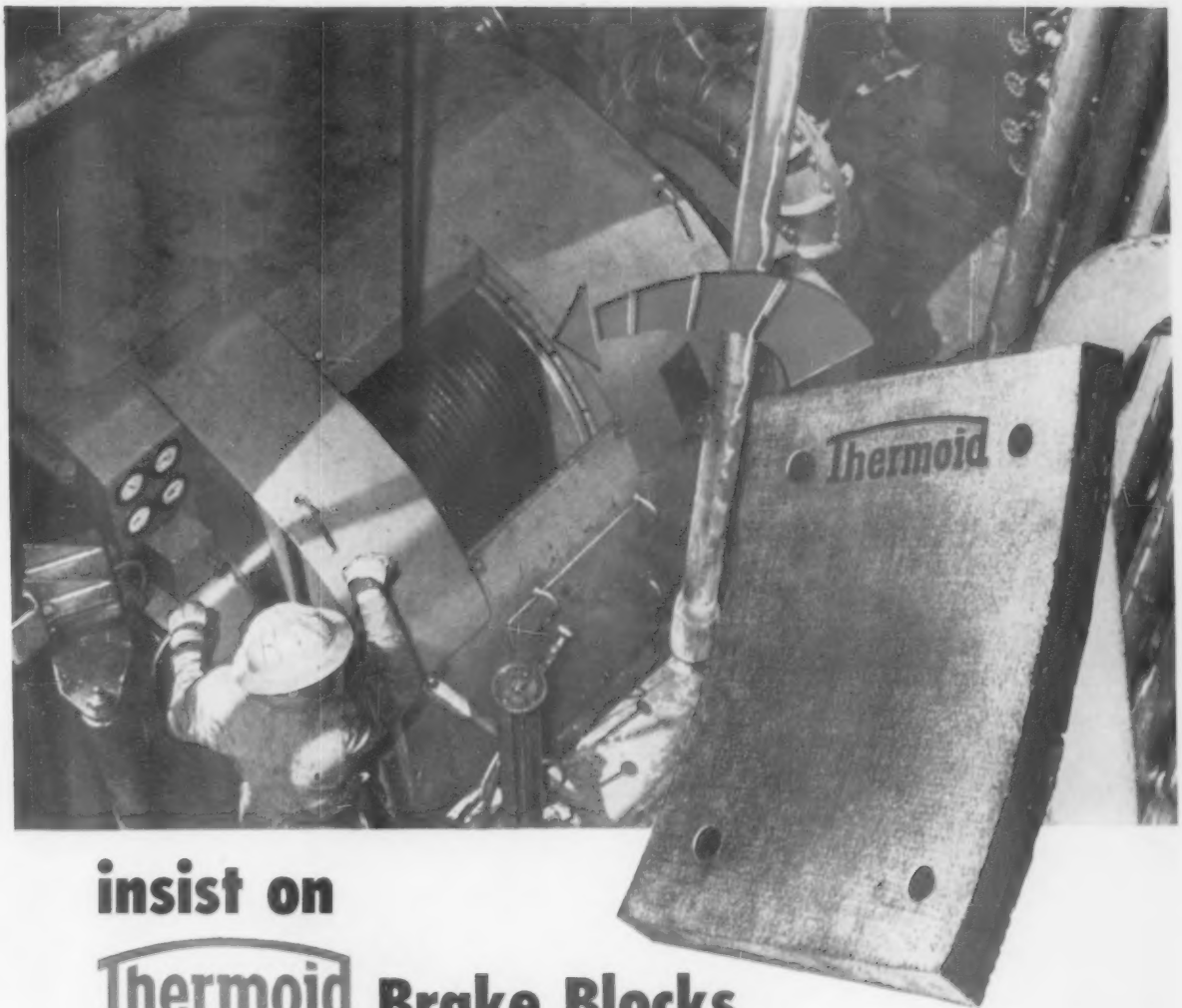
South Bend 21, Ind. • Torrington, Conn.

District offices and distributors in principal cities of United States and Canada

90th ANNIVERSARY 1866-1956

TORRINGTON BEARINGS

Spherical Roller • Tapered Roller • Cylindrical Roller
Needle • Ball • Needle Rollers



insist on Thermoid Brake Blocks for smooth, positive braking action

Super tough, woven Thermoid Brake Blocks have what it takes to operate day after day, 24 hours a day with uniform friction, extra safety and freedom from wear. They withstand highest operating temperatures without crumbling, or loss of shape.

Special resins used in Thermoid Brake Blocks prevent bleeding—leave no residue on drums. The Thermoid split-type sleeve prevents chucking. And because the braking surface is pre-ground, no "running in" is necessary. All these features add up to *less down time . . . lower maintenance costs!*

That's why Thermoid Brake Blocks are the choice of leading original equipment manufacturers and drilling contractors. It will pay you to insist on Thermoid.

For rugged oil field service, always specify Thermoid Powerflex Rotary Hose and Powerflex hi-capacity V-Belts.

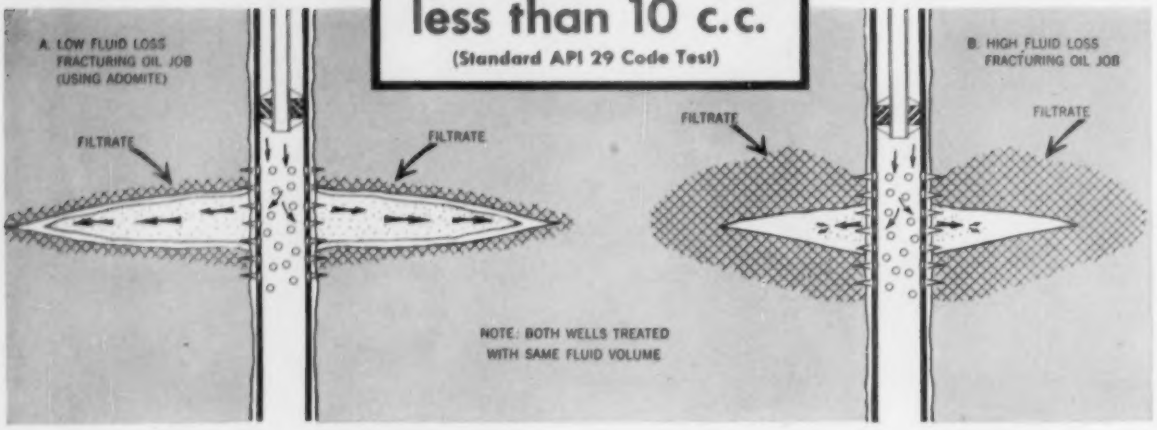
Thermoid

Thermoid Company
Offices and Factories
Trenton, New Jersey • Nephi, Utah

For more productive fracturing . . . least fluid loss

specify Adomite*

Cuts fluid loss to less than 10 c.c.
(Standard API 29 Code Test)


A. LOW FLUID LOSS FRACTURING OIL JOB (USING ADOMITE)
FILTRATE
FILTRATE
NOTE: BOTH WELLS TREATED WITH SAME FLUID VOLUME
B. HIGH FLUID LOSS FRACTURING OIL JOB
FILTRATE
FILTRATE

Adomite is the remarkable fluid-loss control additive that is building production and profits virtually everywhere it is used. Very small amounts of Adomite reduce the API fluid loss of lease crudes to 10 c. c. at most reservoir conditions. With gelled crudes, even smaller quantities are required. *Easy to use*, Adomite is a dry material in flake form that is mixed directly into the crude or gelled crudes on the lease. Only standard mixing equipment is required.

*Trade-mark, Continental Oil Company

Only Adomite can do so many things so effectively . . .

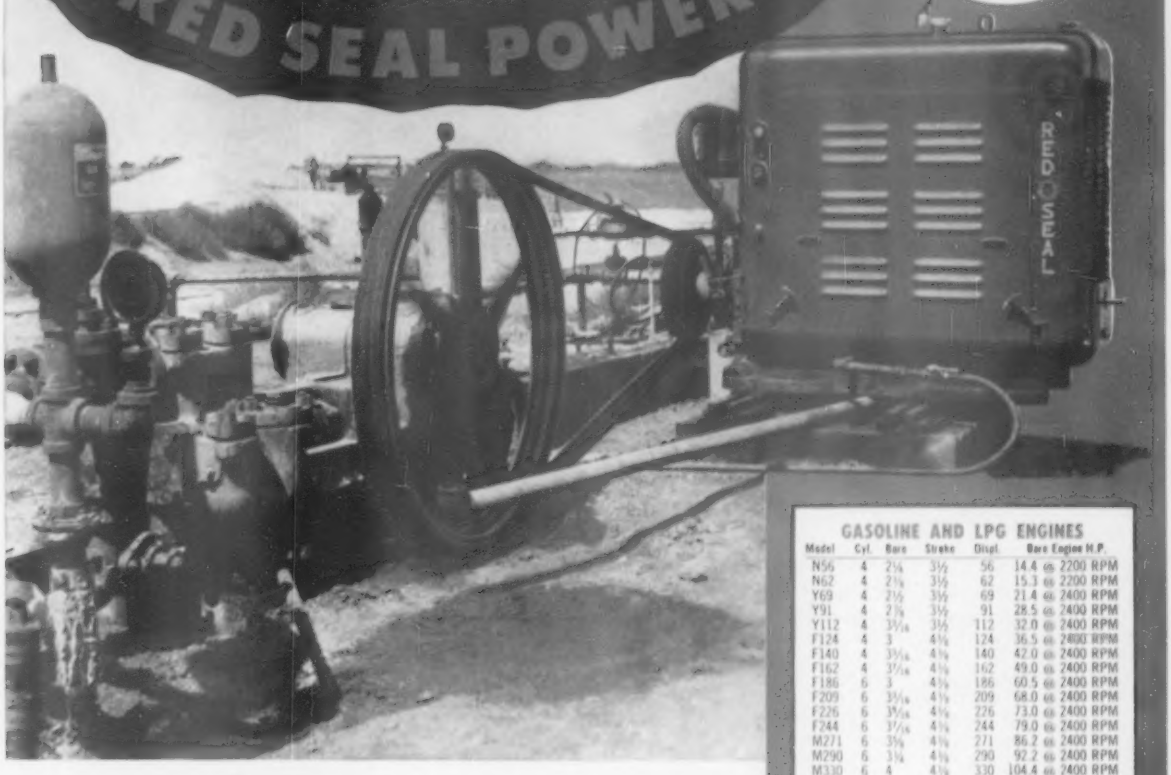
- Seals the fracture face—minimizes fluid loss.
- Longer fractures—deeper penetration of sands.
- Greater sustained production with a given fluid volume at lower cost.
- Saves you money—utilizes lease crudes—less pumping.
- Cleans up quickly—does not contaminate produced oil or the formation.
- Fewer "Sandouts."
- Profitably used for "drilling in" and "work overs."

© 1956, Continental Oil Company

Be sure to specify Adomite on your next fracture job

for Dependability and Economy Standardize on RED SEAL POWER

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD ®



The petroleum industry's widening use of Red Seal engines traces mainly to two factors. One is the broad diversification of the Red Seal line—more than 100 basic models, from 14 h.p. to 1,000-plus*, for use on all standard fuels . . . The other is Continental's long standing reputation for dependability—their inbuilt capacity to deliver more power, longer, at lower cost. Ask for them at your supply store.

*High-output air-cooled military models developed jointly by Army Ordnance and Continental are now available for commercial applications where high output (375 to 1,000-plus h.p.) low weight, and exceptional compactness are required. For information, address Continental Motors Corporation, Military Division, 76 North Getty Street, Muskegon, Michigan.

1955 WINNER NATIONAL SAFETY COUNCIL PUBLIC INTEREST Award

PARTS AND SERVICE EVERYWHERE

GASOLINE AND LPG ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2¼	3½	56	14.4 @ 2200 RPM
N62	4	2¼	3½	62	15.3 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2¾	3½	91	28.5 @ 2400 RPM
Y112	4	3 1/16	3½	112	32.0 @ 2400 RPM
F124	4	3	4½	124	36.5 @ 2800 RPM
F140	4	3 1/16	4½	140	42.0 @ 2400 RPM
F162	4	3 5/16	4½	162	49.0 @ 2400 RPM
F186	6	3	4½	186	60.5 @ 2400 RPM
F209	6	3 1/16	4½	209	68.0 @ 2400 RPM
F226	6	3 5/16	4½	226	73.0 @ 2400 RPM
F244	6	3 7/16	4½	244	79.0 @ 2400 RPM
M271	6	3⅝	4½	271	86.2 @ 2400 RPM
M290	6	3¾	4½	290	92.2 @ 2400 RPM
M330	6	4	4½	330	104.4 @ 2400 RPM
M363	6	4	4 15/16	363	128.9 @ 2800 RPM
B371	6	4½	4½	371	110.0 @ 2400 RPM
B427	6	4 5/16	4⅞	427	127.0 @ 2400 RPM
G134	4	3½	4½	134	34.2 @ 2000 RPM
G157	4	3½	4½	157	40.0 @ 2000 RPM
E201	4	3⅝	4⅞	201	65.4 @ 2400 RPM
H227	4	3⅝	5½	227	54.0 @ 1800 RPM
H243	4	3¾	5½	243	57.9 @ 1800 RPM
H260	4	3¾	5½	260	62.0 @ 1800 RPM
M277	4	4	5½	277	66.4 @ 1800 RPM
K363	6	4	4 15/16	363	123.0 @ 2400 RPM
J382	4	4½	6	382	74.0 @ 1400 RPM
T371	6	4½	4⅝	371	119.0 @ 2400 RPM
T427	6	4 5/16	4⅞	427	140.0 @ 2400 RPM
U501	6	4⅝	5⅛	501	159.0 @ 2400 RPM
R513	6	4½	5½	513	164.3 @ 2400 RPM
R572	6	4½	5½	572	182.4 @ 2400 RPM
R602	6	4⅝	5½	602	191.7 @ 2400 RPM
V603	8	4⅛	4½	603	220.0 @ 2800 RPM
S749	6	5½	5½	749	217.0 @ 2200 RPM
S820	6	5½	5½	820	237.0 @ 2200 RPM

CUSHIONED POWER DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
ZD129	4	3⅛	3⅛	129	36.0 @ 2000 RPM
GD157	4	3½	4½	157	39.0 @ 2000 RPM
*ED201	4	3⅝	4⅞	201	45.8 @ 2000 RPM
HD243	4	3¾	5½	243	55.0 @ 2000 RPM
*HD260	4	3¾	5½	260	59.0 @ 2000 RPM
*HD277	4	4	5½	277	63.2 @ 2200 RPM
*JD382	4	4½	6	382	72.5 @ 1600 RPM
TD427	6	4 5/16	4⅞	427	106.0 @ 2000 RPM
RD572	6	4½	5½	572	154.0 @ 2000 RPM
VD603	8	4½	4½	603	175.0 @ 2600 RPM
SD802	6	5 5/16	5½	802	202.0 @ 1800 RPM

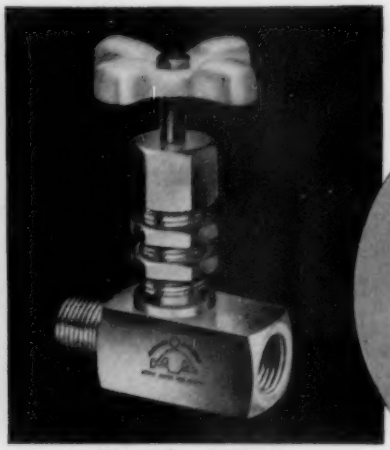
*Available for industrial applications only.

Continental Motors Corporation

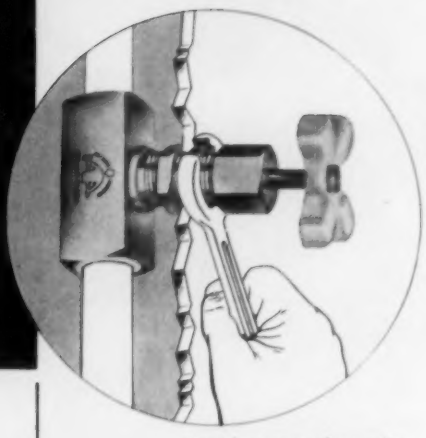
MUSKEGON • MICHIGAN

6 EAST 45TH STREET, NEW YORK 17, NEW YORK • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GEORGIA

For panel mounting with double female connections.



For panel mounting with male inlet; female outlet.



A quick, trim panel mounting with a twist of a wrench.

Panel mounted in seconds!

Did you know that the best needle valve is also best for panel mounting?

Look at the valves above . . . specifically designed for panel mounting. No holding fixtures are needed. Simply remove the packing nut and one of the holding nuts; slip the stem through the panel opening and reassemble. The valve handle is packed separately to speed up the job — literally done in seconds.

You get a neater installation at lower cost . . . just one more proof that we have thought of everything in the Marsh 1900 series. Note the unduplicated features opposite. Ask for Needle Valve Catalog covering all details.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation* **Dept. L, Skokie, Ill.**
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

MARSH *Needle Valves*

MARSH

The ultimate in Needle Throttling Valves

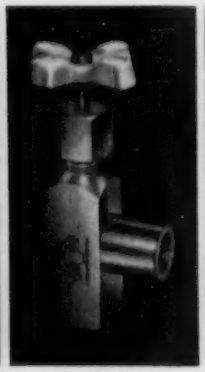
All Marsh Needle Valves — for both panel and standard mounting — share these features that are combined in no other valves.

- **Maximum working pressure: 10,000 psi** — for water, oil, or gas. Equally effective in lower pressure ranges.
- **One piece.** Body and stem-guide are fused into one piece by Marsh "Conoweld" process. No danger of stem leaking or blowing out.
- **Precision machined and ground stem** —of 416 stainless steel. Easier to operate at higher pressures.
- **Finer regulation**—provided by long fine stem threads which also give added strength.
- **Machined from heavy bar stock**— Both body and stem-guide. Sturdiest basic construction known.
- **Deep "Marpak" packing**—longer lasting; easier to renew.
- **Deep throats and thread chambers** —for tight make-up of piping.
- **Handsome appearance**—Electro zinc plated body, set off by sturdy malleable iron handle finished in heavy, attractive, yellow baked enamel.
- **Clear markings.** Bodies marked in accordance with M.S.S. regulations showing size, material, service symbol, maximum pressure.

The standard series is shown opposite.

Standard globe pattern with double female connections.

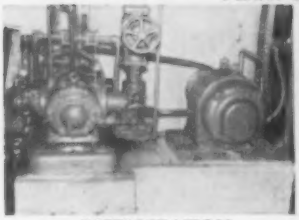
Standard angle pattern with male inlet; female outlet.



Standard angle pattern with double female connections.

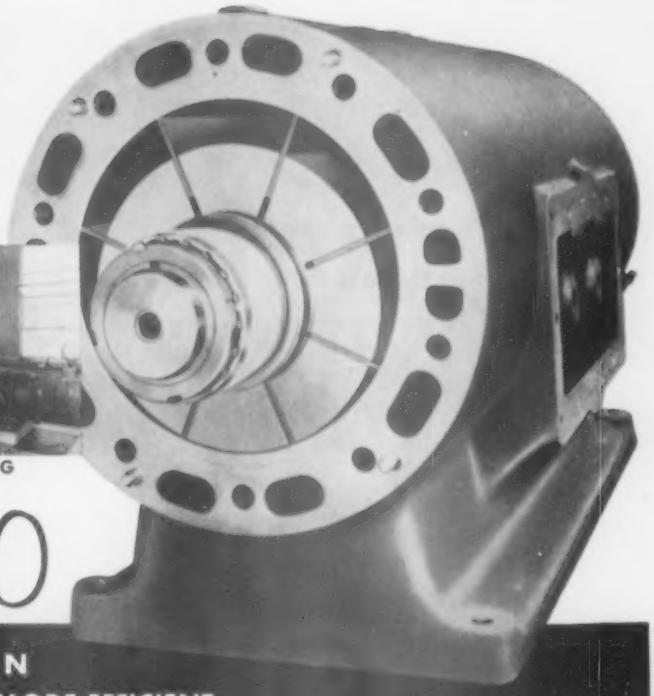
Standard globe pattern with male inlet; female outlet.

PLANT SERVICES



REFRIGERATION

GAS GATHERING



Since 1930

. . . FULLER ROTARY MOTION has been the key to SMOOTHER, MORE EFFICIENT, LOWER COST AIR COMPRESSION

The unique revolving principle pioneered by Fuller is the heart of the Fuller Rotary Compressor—both single- and two-stage types—and provides impressive cost, maintenance and operating advantages.

Simplified Fuller design consists essentially of a rotor eccentrically mounted in a cylinder to form a crescent divided into sections by the rotor blades. Each section or pocket carries air from one end of the crescent to the other without reversal of flow and with measurable improvement in volumetric efficiency. The rotor blades move freely by centrifugal force alone and compensate automatically for wear. As a result, Fuller Rotaries can operate indefinitely without care and the occasional inspection check required can be made with fewer men and in far less time.

Clip, fill in and mail the coupon for detailed information about Fuller Rotary Compressors for plant services, refrigeration or gas gathering.

FULLER COMPANY
132 Bridge St., Catasauqua, Pa.
A SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORP.
Chicago • San Francisco • Los Angeles • Seattle • Kansas City • Birmingham

Fuller
pioneers in harnessing Air

C-265
1-3002

COST-SAVING ADVANTAGES

1. Smooth, pulse-free, one-way air flow
2. Almost complete lack of vibration permits use of light foundation
3. Far fewer moving parts insure low maintenance
4. Small size for high capacity permits installation in minimum space
5. Direct drive further reduces space requirements
6. Valveless design permits continuous, unsupervised operation and greatly reduces maintenance

Fuller Rotary Compressors:

- Maintain original capacity for the life of the machine
- Provide a high degree of reliability, thereby reducing standby capacity requirements
- Have few moving parts, thus sharply reducing parts inventory
- Require minimum supervision and inspection

It will pay you to compare Fuller Rotaries with other compressors and evaluate Fuller advantages to your operation in terms of annual net savings. Fuller Rotaries are available for industrial pressures to 125 psig and capacities to 3300 cfm. We will be glad to supply you with facts based on actual experience with Fuller installations over the past 25 years.

FULLER COMPANY
132 Bridge St. Catasauqua, Pa.

Please send me, without obligation, descriptive literature on the Fuller Rotary Compressor. I am specifically interested in a pressure of _____psig and a capacity of _____cfm, to be used for:

NAME_____ ☐ Plant Services

TITLE_____ ☐ Refrigeration

CO. NAME_____ ☐ Gas Gathering

STREET ADDRESS_____

CITY_____ ZONE_____ STATE_____

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They Say—

Will Suez Trigger W. W. III?

"Gamal Abdul Nasser is not another Hitler . . . He works hard, seldom relaxes, and never drinks. He is absolutely honest and insists on honesty in his ministries.

"Nassar is ambitious for the improvement of his country and her people. His concept of what is justified to achieve that ambition may not correspond to our concept, but it is untrue to say that the nationalization of the Suez Canal Co. violated international law or treaty. There is no real body of international law on the subject, but the nationalization follows several precedents such as the Iran oil seizure, which have never been successfully challenged.

M. K. NEPTUNE

"The Suez Canal crisis could be the trigger of World War III, but I do not believe so.

"Maximum operation of the canal is important to all parties, and a peaceful solution to the situation will be found. It will probably not be reached until there is a conference of which Egypt is at least a cosponsor, and the final solution probably will take the form of a jointly sponsored trustee organization to handle the financial functions of the canal organization, and possibly, the compensation of the shareholders of the old company."

Millard K. Neptune, general manager of Sahara Petroleum Co., Alexandria, Egypt, in a speech before the Kansas City meeting of the American Institute of Electrical Engineers.

Something for the Birds

Dear Sir:

The object of this letter is to obtain your advice on a problem which we have experienced during the last 2 years on a gas plant in western Venezuela.

Some years ago, some swallows found out that the steel girders, stairways, etc., of our plant were an excellent place to rest and spend the night. Of course, they told their friends and girl friends about this nice place, and the result is that after 2 years' time every horizontal piece of iron is covered with these birds during night time.

They arrive at sunset and leave at

This is the barge that drilled the world's deepest well!

Like so much other oil-marine equipment that has played an important part in establishing "notable firsts" in tidelands operations, the Keystone-Slaughter drilling barge which figured in the drilling of the Humble LL & E No. 1-L by Richardson and Bass, John W. Mecom, and Freeport Sulphur Co., was built by

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sunrise. Naturally in the morning the whole plant is covered with their excrements. The area is so large that it is impossible to keep the place clean. The smell in this area, therefore, is awful.

We tried to blow them away with steam and water, but the result was nihil. Because when we blew at one place, they sat down at other places where we were not blowing. Besides, we do not like to kill them. Some hawks have been flying around during their arrival and departure time to have their dinner and breakfast. There are so many swallows, however, that a few less does not make any difference and probably they multiply faster than the hawks can eat them.

We also made an experiment with a tape-recorder. A swallow was caught (you just take one from the steel structure when they are sleeping) and the chirping noise which it produced when we stuck it with a sharp pin was recorded on tape. A loud speaker was installed in the structure and during the evening we passed the tape through the recorder. This did not work out either because the noise produced by the petrochemical furnaces and the rotating process pumps was so much louder than the loud speaker.

Anyhow, the birds are still there and we are looking forward to your appreciated advice to get them out of our plant.

W. J. de Jongh
Gas Plant Supervisor
Cia. Shell de Venezuela
Maracaibo, Venezuela.

(Editor's note: Any helpful ideas will be forwarded to Reader de Jongh.)

The Tubular Goods Shortage

"In a free economy such as ours the existence of markets for any product or service is almost a guarantee that that product or service will be supplied if it is physically possible to do so. I do not believe that steel is an exception. It is well, however, to examine some of the problems faced by the steel industry . . .

"Since the steel industry must depend on newly built facilities to get significantly more tubular products, there is little prospect of large increase in the supply of these products over the next few years.

"Under such circumstances, pipe, and oil country tubular goods will not be in free supply in the immediate or near future. That does not necessarily mean critical over-all shortages. Such a situation can, however, handicap the very rapid expansion of an individual operation. Such a situation also probably means that as individual operators you may not be able to accumulate what you consider to be comfortable inventories."

Henry J. Wallace, sales vice president, United States Steel Corp., in a speech at Mobile, Ala., presented to the Alabama-Mississippi division of the Mid-Continent Oil and Gas Association.

The Art of Public Relations

"All public utilities have in common a peculiar problem . . . More than most industries, public utilities are confronted always with the problem of staying out—or getting out—of the public dog house.

"Public utilities dealing with a natural resource are especially plagued. It is so easy to suggest that they get it for nothing—sometimes with tax benefits—and sell it for a price. That, of course, is malarkey . . .

"That's where public relations becomes of instant and vast importance to public utilities. The art of public relations is the art of keeping the public and the politicians intelligently informed of your operations in terms of the general welfare and the benefit of

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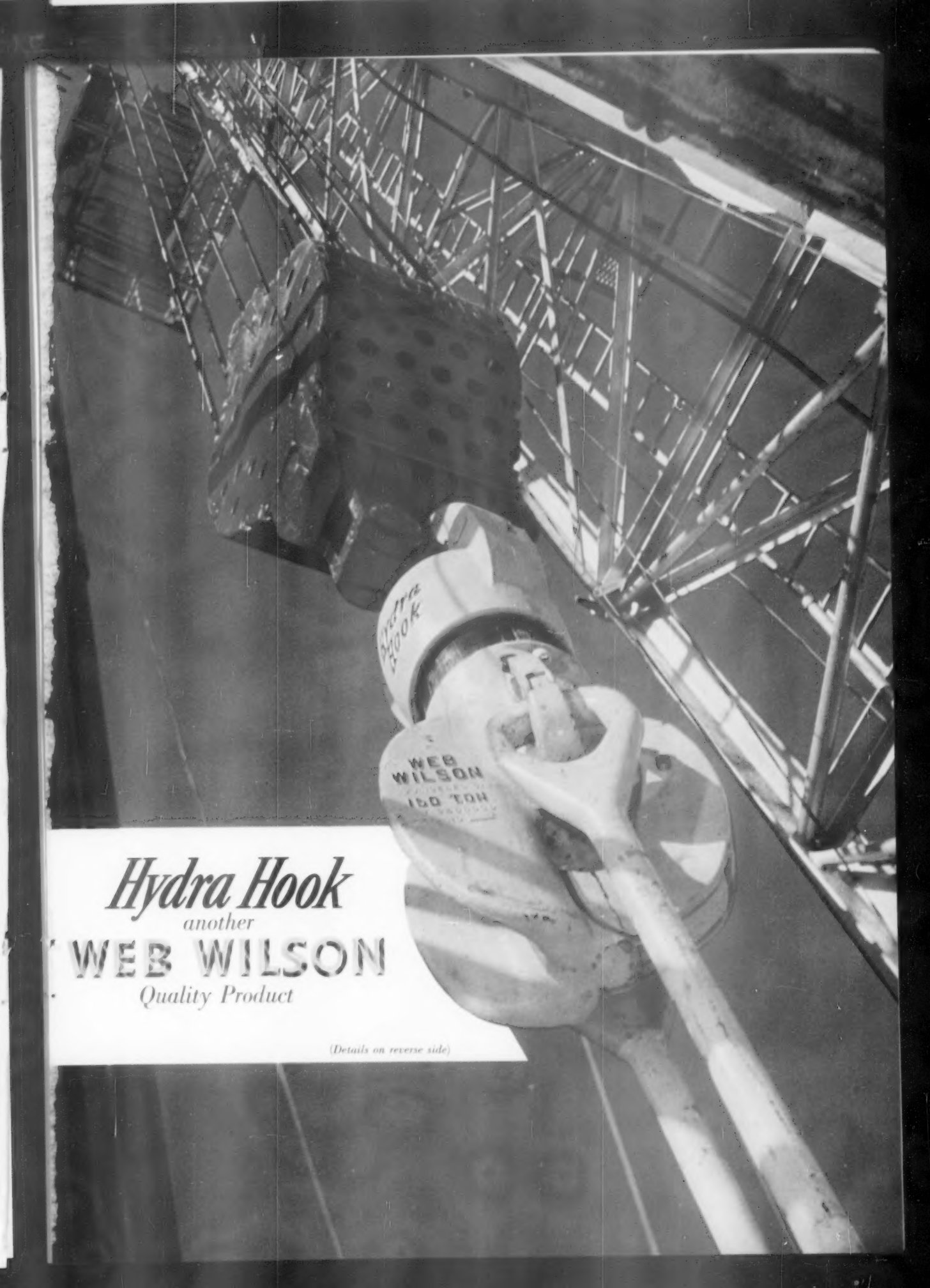

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ALL SIZES FALL FAST AND FREE—Even the smallest *HYDRA HOOKS* have plenty of weight to fall fast.

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the community as a whole . . . If the benefit is there, modesty or ignorance or sloth should not be permitted to keep that fact a secret from the public.

"I have the highest regard for public-relations men. I find them uniformly helpful in my business. But, public relations begins at the top. The real public-relations man of any corporation is the president or board chairman. The man he hires for the immediate P.R. job cannot rise an eighth of an inch above the president or chairman's own concept of public relations and what to do about his company's relations with the public and with politicians."

Lyle C. Wilson, United Press Washington Bureau manager, in a speech to the Independent Natural Gas Association of America, at San Antonio, Tex.

CALENDAR

OCTOBER

10-12 International Geological Symposium of the Williston Basin, Bismarck, N. D.

11-12 California Natural Gasoline Association, fall meeting, Sheraton Huntington Hotel, Pasadena, Calif.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

14-20 OIL PROGRESS WEEK.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

18-21 Permian Basin Oil Show, Odessa, Tex.

22-24 National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

23-26 National Association of Corrosion Engineers, south central region, San Antonio.

24-26 Tracerlab Symposium on Applications of Radioactivity, Hotel Statler, Boston.

25-26 American Society of Mechanical Engineers, American Institute of Mining, Metallurgical & Petroleum Engineers, nineteenth annual meeting, Sheraton Park Hotel, Washington.

26 Natural Gasoline Association of America, southern regional meeting, Captain Shreve and Washington-Youree Hotels, Shreveport.

26 American Institute of Chemical Engineers, South Texas Section, eleventh annual technical meeting, Galvez Hotel, Galveston, Tex.

29-30 Illinois Geological Survey, Petroleum Engineering Conference on Waterflooding, University of Illinois, Urbana, Ill.

29-30 Independent Petroleum Association of America, twenty-seventh annual meeting, Statler-Hilton Hotel, Dallas.

29-31 Energy Resources Conference, sponsored by the Denver Chamber of Commerce, Denver.

29-Nov. 1 Society of Exploration Geophysicists.

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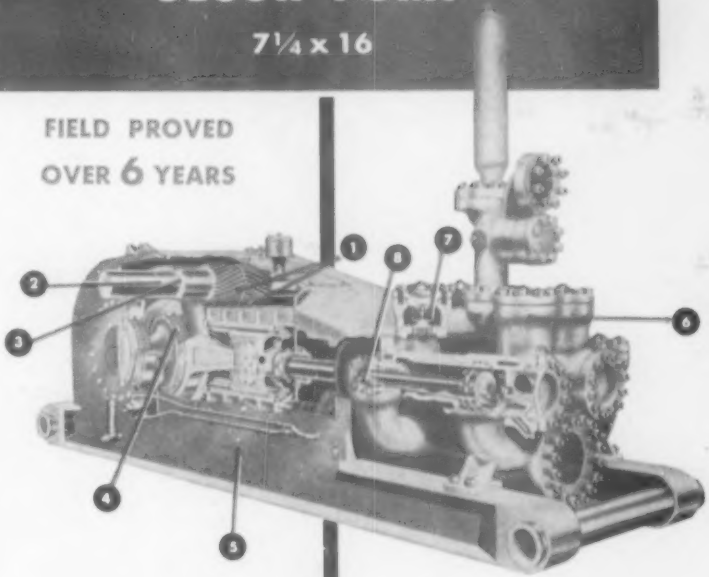

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Large photo: Three Ideco Mud-Master Duplex Slush Pumps undergoing comprehensive factory tests to record data on capacity and pressure variation with both parallel and series compounding.

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Regular and Jet Type

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Main Office and Plant:
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annual meeting, Roosevelt Hotel, New Orleans.

31-Nov. 2 Gulf Coast Association of Geological Societies, sixth annual convention, Plaza Hotel, San Antonio.

NOVEMBER

1-2 Louisiana Polytechnic Institute, fifth annual instrumentation conference, Ruston, La.

7-8 Instrument Society of America, Philadelphia Section, symposium on process data logging, Stratford Hotel, Philadelphia.

8 West Central Texas Oil and Gas Association, annual technical and membership meeting, Hotel Wooten, Abilene, Tex.

8-9 American Association of Oilwell Drilling Contractors, eleventh annual drilling safety clinic, Statler-Hilton Hotel, Dallas.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Coast Joint Regional Meeting, Ambassador Hotel, Los Angeles.

8-9 Society of Automotive Engineers, Inc., national fuel and lubricants meeting, Mayo Hotel, Tulsa.

12-15 American Petroleum Institute, thirty-sixth annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-27 Kansas Independent Oil and Gas Association, nineteenth annual meeting, Broadview Hotel, Wichita.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

30 Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

3-4 New Mexico Oil and Gas Association, annual meeting, Alvarado Hotel, Albuquerque.

6-8 Interstate Oil Compact Commission, annual meeting, Fontainebleau Hotel, Miami Beach, Fla.

9-12 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Boston.

11-12 Water Quality Control for Subsurface Injection, conference sponsored by the University of Oklahoma, Norman, Okla.

1957

JANUARY

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

14-18 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

21-55 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

FEBRUARY

17-18 Engineers, Joint Council, Statler Hotel, New York.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

Drilling Education

THE boys in our engineering department had a terrible letdown last week.

They had just finished putting the final touches on the slew of drilling articles for this, our annual special drilling issue. They were pretty proud of their collection of good material, and particularly of all the original work in the staff-written jobs. They figured this would really help everybody in the drilling business.

Then came the letter. It was from a man in Iowa, and it read:

"I am a foreigner, completely new to the oil business, but do intend to go into business myself.

"What I would like to get is all the possible information on the sinking of an oil well, the complications before the sinking, and also after the well has been sunk. If you could help me out I would be forever grateful.

"Could you give me a rough estimate of how much finance would be needed for the equipment and the sinking of a 500-ft. oil well?

"I do hope you can help me out."

Sadly the boys realized that here was one customer who wouldn't be able to get any value out of all the good dope on drilling practices they had packed into this issue. What this man needs is a primer, not advanced technical information such as we carry.

All the articles the Big Yellow Book has printed in its 54 years of operation wouldn't begin to tell this man all the complications in "sinking" an oil well. The complications are so many that nobody could possibly list them all, let alone give their solutions. Most of them can be learned only by experience, in spite of the excellent supplemental educational service performed every week by our favorite oil publication. We predict that all this man will succeed in sinking is his money.

As for helping him out, it was concluded that the best way would be to find out which way he came in and then politely escort him back there.

But if he persists in his determination to go into the business himself, he might get acquainted with some of the complications by signing on with Great Western Drilling Co. and going through the drilling school described on page 170.

Slips, Little and Big

JUST so you won't think that we think that we're all complete experts on the drilling business, we will admit to a slight deviation in terminology a few issues back.

In a biographical sketch of James A. Tong, new president of Socony Mobil Oil Co. de Venezuela, we mentioned that he started as a roughneck on a cable-tool rig. But that didn't get past one of our eagle-eyed subscribers, who wrote:

"I suggest a special medal should be struck for this man. It just must be the first and only case on record of anyone roughnecking on a cable-tool rig."

The man's right. We should have called him a tool dresser.

But what burned us up, personally, was that this reader addressed his comment to us, personally, and implied that we, personally, pulled this horrible boner. And to add insult to injury, the same mail brought a letter to another staff member in answer to an explanation for another and equally serious slip, in which he said:

"Frankly I'm disappointed that the error wasn't Henry's because I'd understood he makes all the errors in the Journal."

For the benefit of our 37 loyal readers we want to make it clear that we, personally, don't make any little bitty errors. When we make a mistake it's a beaut.

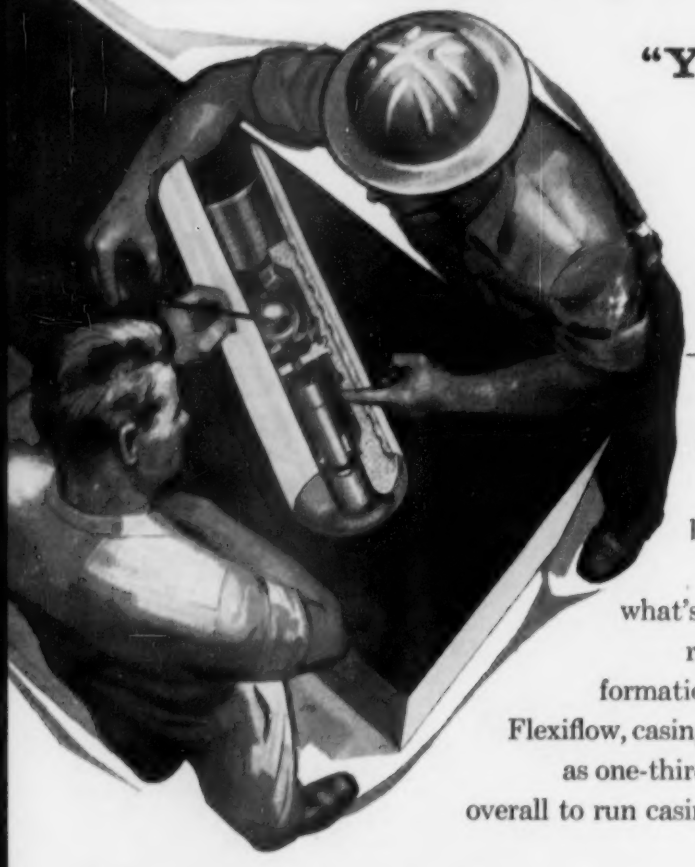
Citified Rig

BUT to get back to this drilling issue, we got quite a start out of the headline about hush-hush drilling in California. We thought for a minute it was going to be an expose of those fantastic underwater oil wells the California politicians allege the oil companies are secretly drilling off their coast.

But it's just about how to drill in a crowded city without noise, smell, or fuss. After reading this, West Texas drillers will have another reason to love the wide open spaces.

—*Henry D. Ralph.*

Heard over a supply store counter...



"You mean it actually costs less to run casing with FLEXIFLOW?"

"That's right... because Flexiflow fills the casing automatically as it is being run, you save the time required to fill the casing at the surface. And what's more, you can run casing at a faster rate, without fear of damaging the formation with high-pressure surges. With Flexiflow, casing running times can be reduced by as much as one-third. That's why it costs much less overall to run casing with Flexiflow."

Flexiflow's Flexible Flow-Control Diaphragm *automatically* adjusts itself to compensate for increases in pressure—automatically relieves harmful pressure surges before they can act on the formation. The higher the pressure from below, the more the hole through the diaphragm expands. And after the first few joints of casing have been run, the hole expands to the point where a joint is filled as each new joint is run. This, of course, is the condition that provides maximum relief from pressure surges (Ram effect). After each joint is run, the hole returns to its original diameter, controlling the fill and preventing overfill of the casing.

Another very important fact about the pressure-relief provided by Flexiflow, is that, in addition to minimizing the danger of breaking down a potential lost circulation zone and setting up a possible bad cement job, the chances are very good that you are at the same time *protecting the producing life of the well.* Pressure surges, created by the use of conventional floating equipment under certain conditions, drive a portion of the well fluid into the formation and tend to "mud-off" the producing zone. This can seriously cut down the production of a well. By using Flexiflow to relieve these pressure surges you are actually protecting the producing formation.

Baker Flexiflow Fill-Up Shoes *(Product No. 160)* and Collars *(Product No. 161)* provide all of these protective features and, in addition, contain the time-tested ball-type back-pressure valve for cementing.

Available now at your supply store, Flexiflow Equipment may be obtained in either conventional form or with the added feature of Baker exclusive Whirler Ports *(Product Nos. 162 and 166)*. Uniform distribution of the cement as it is pumped from the shoe or collar can be as important as having the casing centered in the hole. These whirler ports provide added assurance of getting that uniform distribution, since the cement is forced around and around the casing as it leaves the shoe, minimizing the possibility of channeling.

Baker Fill-Up Equipment, conventional or whirler, used in proper combination with Baker Casing Centralizers and Baker Wall Scratchers, provides you with maximum assurance of successful primary cementing.

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Baker Casing Centralizers
Baker Wall Scratchers

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BAKER FLEXIFLOW

How drilling contractors can lick the competition

Is there really too much competition in the drilling industry? Drilling contractors perennially complain that competition, particularly of the "cut-throat" variety, keeps them from raising their prices in line with rising costs.

This is undoubtedly true, but it's not necessarily bad.

Drilling costs have virtually doubled since the war, but the price of drilling a foot of hole is about the same or less. Something in the neighborhood of 80 per cent of the increased costs has been offset by technological improvements in equipment and know-how that have increased the penetration rate. The rest has largely been absorbed by tightening loose overhead and other practices throughout the business.

THIS IS A FINE EXAMPLE of the classic virtue of the competitive system, of which American industry is so proud. Of course some contractors haven't been able to keep up with the efficiency parade and are falling by the wayside, but that, too, is part of the system.

"It's been good for us," one contractor admits. "We've had to tighten up on loose and sloppy methods all down the line. It's made us cost conscious. And now that we know more about our real costs we can bid more intelligently."

But there's probably not much slack left in the drilling business, not many places left to cut costs. Penetration rates and business efficiency may have reached a plateau. Any further increases in real costs may have to be passed on to the well owners in the form of higher contract prices.

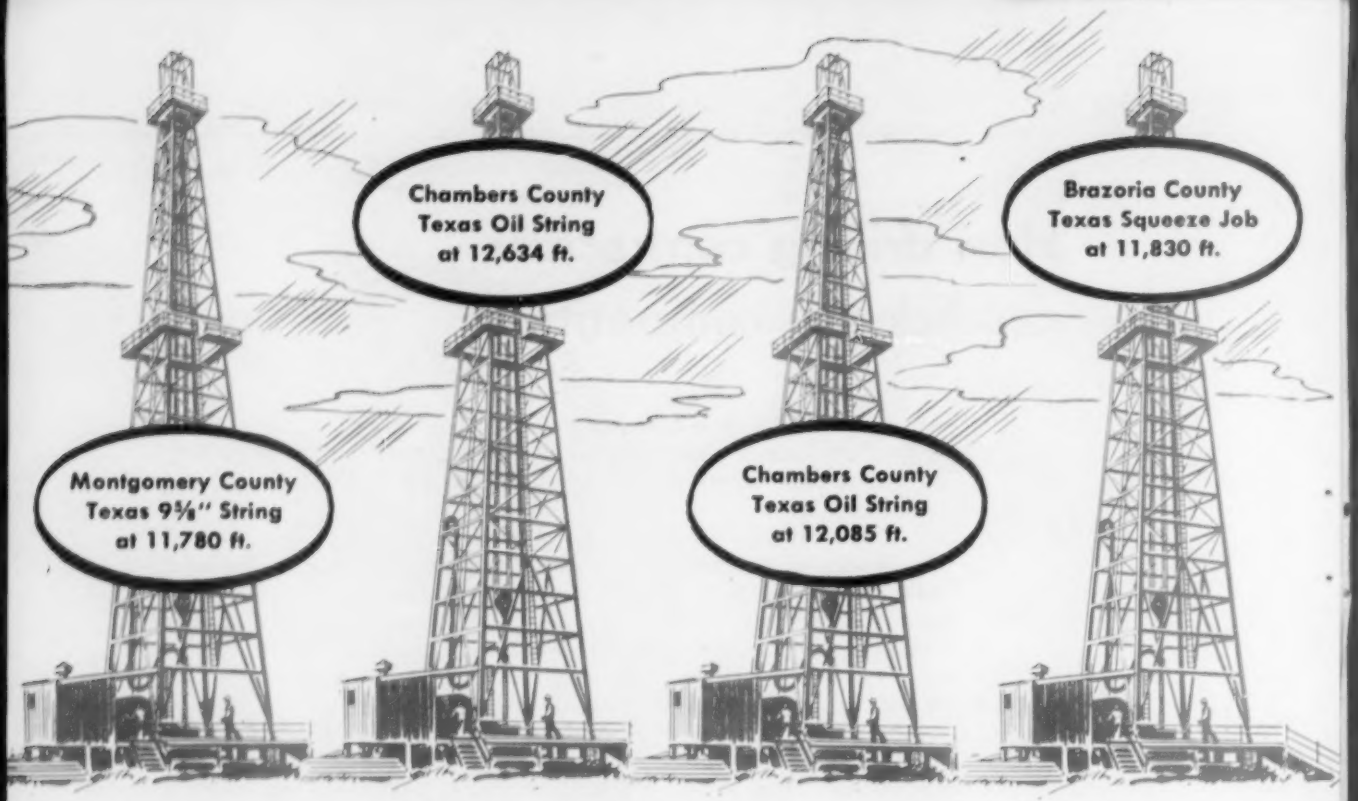
That's the nub of the problem, of course. And as long as wells are drilled on competitive bids, it always will be. Since no change in the method seems likely, and since contractors can't legally conspire to boost all bid prices, the problem gets back to the individual bidder.

THIS BOILS DOWN to salesmanship. A bidder must convince an operator that his bid, though not the lowest, is really the best. He must point out the extra value of his experience, equipment, crews, reliability, and service, and show how they can save money for the operator in the long run.

Selling the intangibles of a service is admittedly more difficult than selling a visible gadget. In the past, many drilling contractors were prone to base their selling efforts chiefly on personal friendships with—and personal favors for—certain operators or their employes.

This practice, too, is losing out in today's competition. Cold-blooded and knowledgeable engineers on operators' staffs are swayed by facts, not favors. A new type of selling is in order.

Competition will always be tough in the drilling business. But it's making contractors better technicians, better businessmen, and better salesmen. There's nothing so terribly bad about that.



AS TEXAS GULF COAST WELLS GET DEEPER AND HOTTER

'Starcor' Gives Outstanding Performance

. . . NOW, AS IN 1936

Select Cement to Fit the Job!

● Back in 1936, few wells were drilled below 7500-8000 ft. In some fields, temperatures ranged from 185 to 200°F, with high pressures. Pumping equipment was a long way from what it is today. Operators were often hard pressed to get a good cementing job with "common" cement.

A slow-setting cement was needed—'STARCOR' SLOW-SETTING OIL WELL CEMENT met that need, met it well, as shown by the fact that wells cemented with 'Starcor' a generation ago are still producing, the original cementing jobs holding tight.

Equally outstanding is today's 'Starcor' performance at the greater depths made possible by improved equipment and methods. In the deep, hot Texas Gulf Coast wells, for example (typical jobs, listed above), 'Starcor' is performing perfectly, adding a new chapter to a distinguished service record.

Lone Star offers you four great cements: LONE STAR Cement, standard of highest quality for half a century...'INCOR'*, America's FIRST High-Early, Sulphate-Resistant Cement . . .'STARCOR'* Slow-Setting Oil Well Cement . . .'TEXCOR'* Deep Oil Well Cement. Select the one that fits your job—the extra quality margin is important to you.

*Reg. U.S. Pat. Off.

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Current and significant in . . .

The Industry This Week

Drilling-Exploration

• **Worth of first "flood frac" job** on a Spraberry well is proving inconclusive. The biggest well fracture treatment ever recorded has hiked production only slightly on the Hanley A-2 Driver. But there are indications the treatment wasn't given a fair shake. P. 121.

Richfield has staked location and is building a road to drill the first wildcat in the Kenai National Moose Range in Alaska. P. 121.

Group of American independents who have small-scale production in Venezuela have pooled their assets and announced plans to expand. P. 128.

Pakistan Petroleum finally has bowed to government demands that companies share profits on a 50-50 basis with government. P. 132.

Pipelining

• **Iraq Petroleum will build a 24-in. line** to bypass troublesome Lebanon. The line will go through Syria exclusively, pouring an additional 180,000 bbl. daily of Iraq crude into Syria's Mediterranean port of Banias instead of the Lebanese port of Tripoli. P. 128.

Midwestern-T.G.T. plan to bring Canadian and Gulf Coast gas into Midwest has cleared first hurdle. F.P.C. examiner has turned down protests of project's opponents. P.124.

Size of crude and products pipeline planned from San Juan-Paradox basin area has been increased as new commitments are signed up. Line is planned by Northwest Pipeline Corp., a Pacific Northwest affiliate. Construction will start next May. P. 121.

Offshore

• **Radical mobile drilling platform** is being completed for Kerr-McGee and will go to work in Gulf waters next month. Novel feature: A hull of latticed steel pipe which submerges the unit when flooded and a new-type rig which drills over the side from movable, cantilevered floor. P. 118.

Compulsory conservation practices will be written into all future offshore leases issued by California. State Lands Commission will have power to decide when such operations needed. P. 116.

Industry

• **Talk of a crude-price hike** was revived at last week's meeting of Texas Mid-Continent Oil and Gas Association. The reasoning: Domestic producers must get more for oil to pay costs of increasing output if Middle East troubles should cause oil shortage. P. 114.

Soaring demand for oil in next 20 years means U. S. may become short of oil and need Middle East imports. That's warning of Jersey Standard's Rathbone. P. 115.

Purchase of Southern Production by Sinclair Oil apparently is going through without hitch. Southern Production stockholders will vote on deal this week. P. 120.

Refining

• **A market for at least 30,000 bbl. daily more of asphalt** looms next year from big federal highway program. It may mean a $30-million gain in refinery income and firmer outlet for producers of asphalt crudes. P. 118.

Superpremium gasoline is running above 99-research octane, Ethyl survey discloses. This does not include third grades now being marketed. Ratings on premium and regular are unchanged—97 and 90 R.O.N. P. 123.

Shell is joining Britain's refinery expansion parade. It will add 80,000 bbl. daily to distillation capacity at its Shell Haven plant near London. P. 129.

ROUTE 78 in Alabama is typical of the new highways to be built under the federal program. It emphasizes the fact that . . .

A Big Market Is Opening for Asphalt

- The highway program will add at least 30,000 bbl. daily to demand next year, and the figure will grow as the plan picks up momentum

- Some see even brighter prospects. But there are "ifs": With cash in hand, will highway men watch their costs? Can oil match the sales effort of the cement industry?

C. O. WILLSON

HIGHWAY construction plans, spearheaded by the mammoth federal program, afford the domestic oil industry an opportunity to expand the demand for petroleum asphalt 30,000 bbl. daily next year.

Steadily larger yearly gains are in prospect over the next decade and probably for a longer period.

These prospects mean:

. . . **Refiners** can add $30 million to their plant realizations in 1957 by upgrading products which otherwise would be sold as residual fuel oil.

. . . **Producers** should add importantly to their outlets for asphalt crudes and other asphalt-bearing crudes.

This appears to be a safe estimate of the immediate effects of the $35.5 billion federal provision for 41,000 miles of interstate highways over a period of 13 years. Federal aids for secondary highways and related construction are included.

There naturally are "ifs" in the share that will accrue to the oil industry in the form of petroleum asphalts starting next year and later. Much will depend on how aggressively manufacturers of asphalt and the oil business generally take advantage of the opportunities now presented.

This is true not only on the federal-supported programs but also on the assured larger expenditures in highway and street construction to be financed by state, county, and city funds.

Brighter side . . . Some are even more optimistic regarding the future of asphalt.

They predict that asphalt demand for paving will increase 100 per cent in 3 to 4 years when all phases of the projected programs are under way.

Such an increase would indicate a daily demand for paving asphalt of 360,000 bbl. or nearly 100,000 bbl. daily more than present production of all types of asphalt.

One encouraging factor is that petroleum asphalt no longer occupies a defensive position in competing with portland cement. In fact there is plenty of evidence that the opposite situation now prevails.

For years an aggressive portland cement industry, lead by its resourceful national association, promoted the idea that their product was the ideal paving material and at best asphalt was an unsatisfactory substitute.

Petroleum asphalt suffered from comparisons that were never justified. Because of its flexibility, asphalt is often used in farm to market and similar roads where local officials cannot spend more than a few hundred to a few thousand dollars per mile. These applications are satisfactory for the uses to which they are applied, but they should not be compared, as has been done, with results in primary road construction.

Another contention was that asphalt paving was not adaptable to the needs of major highways and streets subject to heavy traffic. Modern design has nullified whatever merit this contention ever had. Now the properly constructed asphalt paving is fully approved by agencies of the federal Government and most highway departments within the states.

Uses pick up . . . A few figures illustrate this development.

According to the Asphalt Institute 86 per cent or 360,829 miles of all paved highway is now of asphalt construction. Of a total of 1,442 miles of toll roads in operation or under construction, 61 per cent are asphalt.

Representative of comparative costs in major highway construction today

Petroleum Asphalt in the U. S.

1955 Production*

(Based on Bureau of Mines reports)

Asphalts—	Total (bbl.)	Daily avg. (bbl.)	Per cent of total	Number of refineries mfg. asphalt†	Capacity (bbl. daily)†
East Coast	18,965,000	51,959	22.8	19	90,565
Appalachian No. 1	1,113,000	3,049	1.3	2	7,500
Appalachian No. 2	1,917,000	5,252	2.3		
Ind., Ill., Ky., etc.	15,968,000	43,748	19.2	16	62,970
Okla., Kans., Mo.	9,297,000	25,471	11.2	22	47,078
Texas Inland	4,447,000	12,184	5.4	3	6,750
Texas Gulf	5,764,000	15,792	6.9	4	12,400
Louisiana Gulf	5,057,000	13,855	6.1	6	24,500
Ark., La., Inland	4,600,000	12,603	5.5	6	7,250
New Mexico	420,000	1,151	0.5	1	1,400
Other Rocky Mountain	4,471,000	12,249	5.4	14	25,850
West Coast	11,102,000	30,416	13.4	22	68,525
Total	83,121,000	227,729	100.0	115	354,788

*Does not include plants outside petroleum refineries. †The Oil and Gas Journal Annual Survey, January 1, 1956.

Demand by States, 1955

State—	Tons
1. California	1,487,636
2. Texas	1,006,940
3. Illinois	974,572
4. New Jersey	834,064
5. Pennsylvania	833,112
6. Ohio	827,930
7. Florida	562,102
8. Missouri	439,106
9. Indiana	435,036
10. North Carolina	389,435
Total	7,789,933
Percentage of U. S. total	50.1

Trends in Demand

(Figures in barrels)

Year	Total	Daily average	Per cent inc.
1945	39,639,600	108,602	
1946	45,551,000	124,797	14.9
1947	50,285,000	137,767	10.4
1948	51,590,000	140,956	2.3
1949	50,931,000	139,537	—1.0
1950	59,660,000	163,452	17.1
1951	67,437,000	184,759	13.0
1952	73,308,000	200,295	8.4
1953	73,918,000	202,515	1.1
1954	78,445,000	214,918	6.1
1955	86,181,000	236,112	9.9

Demand by Months, 1955

	Daily average	Per cent of year
January	95,581	3.4
February	114,929	3.7
March	149,097	5.4
April	189,000	6.6
May	268,032	9.6
June	354,967	12.4
July	349,613	12.6
August	384,839	13.9
September	350,800	12.2
October	275,000	9.9
November	178,567	6.2
December	115,355	4.1
Total 1955	236,112	100.0

are the toll highways. The estimated cost of 522 miles of portland cement-type of toll roads under construction is $2,507,663 per mile. The average cost of the 574 miles of asphalt-type toll roads under construction is $1,170,228. These toll highways are comparable with the four-lane sections which will be built under the federal interstate program.

While this difference in cost per mile is exceptional, other data show that in major highway construction asphalt paving can be laid 10 to 25 per cent cheaper than the portland cement type.

Supported by these comparisons, asphalt manufacturers have a strong position with all federal agencies which seek to obtain the maximum mileage of major highways from available funds. The federal program also calls for assistance in the construction of secondary roads including other access highways feeding into interstate system. In this type of highway it is believed that the use of asphalt practically will be 100 per cent, and this market is certain to be much greater than during any time in the past. Since the states only pay 10 per cent of the interstate program and 50 per cent of part of the secondary program, this should leave substantial funds for additional highways including farm-to-market roads which are paid for 100 per cent by states and counties. The use of asphalt is also increasing rapidly in street construction in towns and cities.

Too much money? . . . The big danger, however, is that the highway departments of some of the states may be tempted to rush their interstate programs without regard to initial and long-range costs.

This "filthy rich" attitude could result in large expenditures for portland cement highways which will quickly dissipate available federal and state funds and leave the 13-year program far short of realization in some areas.

Regarding portland cement, pertinent data have been gathered on what happens to maintenance costs on these highways after a few years operation, including toll highways. The original Pennsylvania turnpike, now 15 years old, began to disintegrate 4 or 5 years ago. Since 1954 it has been necessary to use a 2-in. coating of asphalt over the concrete for more than 100 miles of the 160-mile toll way. This and many similar situations have shown that even with these competitive highways the asphalt industry has an important market in maintenance programs.

One of the claims being made in the present situation is that the petroleum industry does not have sufficient asphalt capacity to take care of the increased needs under the new programs. According to The Oil and Gas Journal's latest refinery survey, as of January 1 this year, there were 115 refineries in the United States manufacturing asphalt. The asphalt capacity of these plants was 354,788 bbl. daily. The latest available report of the Bureau of Mines shows that these plants are producing at the rate of 260,387 bbl. daily (see table). This leaves a surplus capacity of nearly 100,000 bbl. a day which is sufficient to take care of any expected increases in demand over the next 2 or 3 years.

According to refiners, the capacity of most existing plants could be readily increased. Too, if market conditions justify, additional refiners will install facilities for the manufacture of paving grades of asphalt.

In addition to the capacity at refineries, there are several companies which operate asphalt plants but do not refine crude oil.

In contrast, the cement industry is operating near capacity due largely to the current expansion in building.

Role of institute . . . Credit is given to the Asphalt Institute for many of the

Now "Follow Through"! Get your share of this huge market for ASPHALT

Here's an immediate and great opportunity for the industry to push ASPHALT! Federal-aid highway projects!

Follow through on The Asphalt Institute's big advertising campaign now running in LIFE magazine and other national media. Plan your own efforts to take advantage of the increased interest now centered on Asphalt paving as a result of The Asphalt Institute's continuous and dynamic program.

Remember! More and wider ASPHALT roads will increase the market for Motor Fuels and Lubricants with a minimum tax burden.

THE ASPHALT INSTITUTE
Asphalt Institute Building
College Park, Maryland

ADVERTISEMENT sponsored by the Asphalt Institute, calling attention to its efforts to promote the sale of the oil industry's product.

accomplishments of the past few years in increased use of asphalt. There are plans for further expansion of the Institute's activities over the next several years.

The Institute and its research headquarters are located at the University of Maryland. Most of the manufacturers of asphalt now belong to this organization.

An advertising program of $600,000 was recently approved by the Institute's directors, and it is expected this appropriation will be substantially increased next year and in later years. The 22-man engineering staff of the Institute, which is small in relation to the large organization of the Portland Cement Association, also is being expanded. Other programs have been approved which will strengthen the position of petroleum asphalt with all agencies of government and with the users of all types of highways.

According to the Asphalt Institute, the production of petroleum asphalt last year totaled 17,000,000 tons. This is equivalent to 93,500,000 bbl. or 256,000 bbl. daily. Predictions on the increase this year over 1955 range from 5 to 10 per cent with the larger increase to start next year.

Of this 93,500,000 demand in 1955, 71 per cent was used for asphalt paving, 21 per cent by the roofing industry, and the remainder in a variety of uses. Practically all the demands, in addition to asphalt paving, are steadily increasing. As the table shows, total demands for asphalt have increased every year since the war with the exception of 1949, with more than a 100 per cent increase for the 10-year period ending last year.

Seasonal use . . . But the actual consumption of petroleum asphalt is more seasonal than any of the major products obtained from a barrel of crude. As the table shows, 51 per cent of the consumption in 1955 took place during June, July, August, and September, and 70 per cent for the 6-month period from May through October. This is an important factor in working out efficient plant operation at refineries. However, most plants have developed a satisfactory storage program for either the residual oil or for the finished products.

Other operations going back to the wells have been developed so that production of asphaltic crudes is curtailed during the season of minimum consumption.

Market analysts point out that while petroleum asphalt is used for paving in all 48 states and the District of Columbia, 50 per cent of the actual consumption takes place in 10 states (see table).

This is partly due to the fact that some states are remote from sources of supply. The cost of transportation from plants to destination makes the delivery price unattractive. However, this situation may be changed by educational programs to show the superior value of asphalt highways, and to stress that despite the relatively high delivery costs the total costs are under those of any competitive products. Also there has been progress in reducing transportation costs through the widening use of barges for waterway transportation.

The California story . . . California, which leads all other states by a wide margin in asphalt paving, is generally conceded to have obtained the maximum mileage of improved highways per dollar spent.

Manufacturers of asphalt have cooperated with state and county officials in highway studies to determine what specifications in products were required for particular uses. A lower priced grade was used when it would give satisfactory results.

The manufacturers and highway engineers are given major credit for perfecting the asphalt construction of California highways suitable for the heaviest traffic. This development enabled the state to get approximately twice the mileage of these major arteries that would have been possible had portland cement been used in highway construction.

Price trouble . . . One of the situations that has plagued petroleum asphalt activities is the matter of price.

Manufacturing costs in a representative asphalt operation bear a direct relationship to the prevailing market for residual fuel oil. When fuel-oil prices are low in relation to crude as they have been at times in recent years, they have been responsible for a depressed market in which asphalt grades suitable for paving have been sold with little regard to manufacturing costs.

This situation has improved over the past 2 years and has been reflected in higher prices for all asphalt grades. This has enabled manufacturers to increase research and development expenditures. The result has been wider uses for asphalt in all types of paving.

One phase of this work has been the sponsoring of installations suitable for road and other tests at several points. The tests have been generally favorable to asphalt over competing materials. One result of this type of development was the recent government approval for the use of asphalt for all types of airport runways.

Processing BRIEFS

Standard Oil Co. (Ind.) is entering its 22,000-bbl. refinery at Neodesha, Kans., in the high-octane parade. The plant will get an Ultraformer which will process more than 6,000 bbl. of naphtha daily into 100-plus leaded octane gasoline stock.

The unit will include a naphtha desulfurization section and reforming section. Construction is due to start early next year, with operation scheduled for the start of 1958.

Humble Oil & Refining Co. will build a benzene unit at its Baytown refinery. The unit, which will be one of the largest of its type, will be designed to produce about 24,000,000 gal. of benzene annually. New facilities will include a Udex extraction unit, a clay treater, benzene rerun column, and related installations. Construction is scheduled to start about the second quarter of next year. Production is expected to start late next year or early in 1958.

General Petroleum Corp. will build a 12,000-bbl. Sovaformer at its 128,000-bbl. Torrance, Calif., refinery. It's part of an $8,000,000 expansion program that will also add additional gasoline-fractionating and offsite facilities. Ralph M. Parsons Co. has the contract for most of the new facilities. The Sovaformer is scheduled for completion in October of 1957.

An $850,000 skid-mounted, refrigeration-type propane and butane plant is being constructed at Roggen, Colo., by Natural Gas Products Co. The facility, to be operated by New Drilling Co., will process 6,000,000 cu. ft. of gas daily from the Roggen, Kiowa Creek, Orchard, Riverside, and surrounding fields. Colorado Interstate Gas Co. will take dry gas from the plant. The plant is 50 per cent complete.

A new acetylene plant is planned by Diamond Alkali Co., Cleveland, adjacent to the firm's expanding polyvinyl chloride resin plant at Deer Park, Houston. The facility, broadening Diamond's interest in organic chemicals, is already in the engineering stage. Construction is to start next fall. The company said it considered acetylene "a major organic chemical building block offering an exceptionally promising potential as a source of new chemicals to Diamond and others in the years ahead."

Stockholders of the Chicago Corp. will vote November 27 on a plan to merge Champlin Refining Co. of Enid, Okla., a wholly owned subsidiary, into Chicago Corp. Name of the surviving company would be changed to Champlin Oil & Refining Co. Chicago directors previously approved the plan.

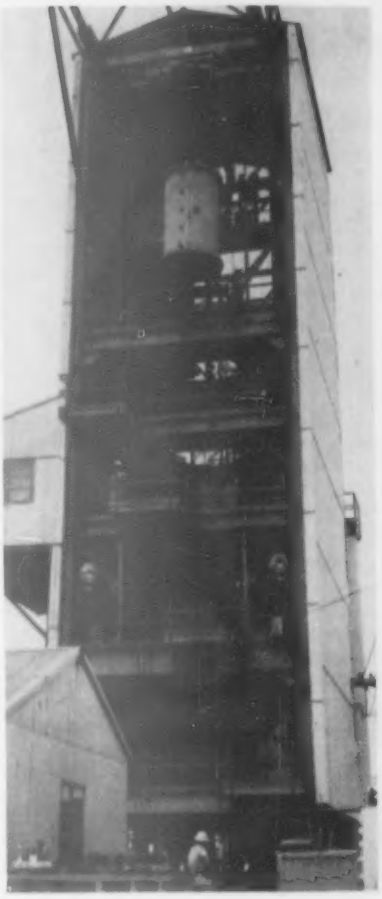
Du Pont Co.'s Petroleum Chemicals Division has raised the price of four antioxidants used in petroleum products. Du Pont antioxidant No. 29 has been raised from $0.95 to $1.04 per pound. Other increases per pound include from 56 to 61 cents for phenyl-alpha-naphthylamine, from 75 to 82 cents for Ortholeum 300 grease stabilizer, and from 54 to 57 cents for phenyl-beta-naphthylamine.

Tidewater Oil Co. is continuing to extend its eastern marketing volume. The latest purchase included the assets of Eastern Oil & Gas Corp. of Riverhead, Long Island, one of its largest franchise distributors on the Atlantic seaboard.

Also for Refiners . . .

Refiners must turn out an additional 30,000 bbl. daily of asphalt in 1957 to meet new demands created by the federal highway-building program (P. 110) . . . Standard of Ohio has some new tricks up its sleeve for 60,000-bbl. refinery planned at Toledo (P. 116) . . . First urea plant using Italian Montecatini process is nearing completion at Shell Chemical's installation at Ventura (P. 117) . . . Sinclair will get a big slice of Great Northern refinery when purchase of Southern Production is closed (P. 120) . . . Beefed-up premiums kick research-octane ratings up to 99 plus in seven cities in Ethyl's September survey . . . Panhandle refinery at Wichita Falls goes to American Petrofina as merger is completed . . . Tidewater's 15,000-bbl. Drumright, Okla., refinery will be liquidated (P. 123) . . . Dow Chemical buys Bay Refining, plans big ethylene plant next to Bay City refinery (P. 124) . . . Tidewater completes first step in expansion at Avon refinery as 24,000-bbl. hydrosulfurizer goes on stream . . . Defense Department will have 25,000 bbl. daily of alkylate available next year (P. 127) . . . Shell will boost capacity of Shell Haven refinery 80,000 bbl. daily (P. 129) . . .

ALSO FOR REFINERS: More tips on refinery painting—Part 6 (P. 257) . . . Cost-imating—how automation cuts gasoline-plant costs (P. 259) . . . Heat supply in distillation (P. 263) . . . and five case histories show how radioisotopes may be used in day-to-day refining operations (P. 268).



Mixed-Up Plant

There's no oil here; this "refinery" handles solids

LINDEN, N. J.—This new pilot plant is a stranger. Not a drop of oil passes through it.

Looming five stories high at Esso Research & Engineering Co.'s research center here, it is used solely to study fluidized solids. Powdered catalyst identical to that used in commercial refining units is fluidized by 8,000 cu. ft. per minute of compressed air sometimes containing traces of helium.

The reactor comprises six 2-ton sections which can be changed to study the effect of internal design on fluidization solids. The reactor measures 45 ft. in height and 5 ft. in diameter. It is studded with over 200 stoppered "portholes" through which air can be sampled for analysis without interrupting operation. Three hoppers handle different catalyst types.

The pilot plant is equipped with the strongest air-operated diaphragm valve ever constructed, a control house located midway up the reactor, and electronic instruments.

Price Hike Talk Revived

● Middle East troubles fire domestic producers' hopes for better prices as incentive to step up U. S. output

HOUSTON.—Talk of a possible increase in the price of crude oil was revived last week at the annual meeting of Texas Mid-Continent Oil and Gas Association.

Despite recent price slumps in several regions, uncertainty of Middle East crude supplies has bolstered the hopes of firmer domestic prices.

Renewed sentiment for higher prices hasn't exactly erupted into a clamor, even among producers. But speakers at the Texas Mid-Continent meeting at least brought the sentiment out of the whispering stage.

Strongest argument for price adjustments came from French M. Robertson, Abilene, Tex., independent and president of the Texas association. He questioned the economics of greatly increasing domestic crude output at today's prices to meet shortages which might result from Middle East turmoil.

Also touching on the prospects for a price increase were L. F. McCollum, president of Continental Oil Co., and W. J. Murray, Jr., chairman of the Texas Railroad Commission.

Drilling incentive needed . . . Murray made no direct pitch for a price increase, but he emphasized that increased drilling will be required if Texas is to sustain crude production at the high levels needed in case of an emergency. The Railroad Commission chairman recently told the U. S. Interior Department that Texas could increase its oil output by 1,000,000 bbl. daily for 6 months. But he made it clear that the increased output could not be maintained for a long period without proper incentives to increase drilling.

Robertson pointed out that it was in his area of West Texas where crude prices recently dropped 7 cents per barrel. Remarking that the oil industry seems to have been "snake bit" this year, he said, "The crude market got soft, the gasoline storage tanks are brim full, the natural-gas bill was vetoed, the price of steel went up, and the dry-hole ratio has increased."

Where Texas stands . . . During the past 10 years, he said, Texas' share in the U. S. oil market has dropped from about 39 per cent to 33 per cent.

"We are just about holding our own volumewise," he continued, "and we've been doing that the last year or two. But volume is not the only yardstick for judging our industry's situation. We are producing about the same volume in Texas this year as we did last, maybe a little more. To do this, however, we have added almost 10,000 wells to our schedules."

In other words, he said, Texas oil men have invested about $500,000,000 in new wells—not counting higher operating costs and dry-hole losses—while their gross income has remained about the same.

FRENCH M. ROBERTSON
"... Oil industry snake bit."

L. F. McCOLLUM
"... Demand pattern changing."

"There seems to be a great deal of comment concerning the ability of Texas and the other producing states to make up any shortages resulting from trouble in the Middle East. The fact that Texas could provide more than a million barrels a day additional for a few months should be comforting to the nation, even to Europe.

"I question, however, the wisdom of economic policies which would skim the cream from our flush fields to meet such an emergency without regard to price policies."

Robertson argued that it is "folly" to abandon or bypass Texas fields where production could be stepped up by secondary recovery "which could be brought into more extensive use with a better price for crude oil."

"If our flush production is produced in an emergency—which I am confident will not last forever—then we will be left with even more costly oil and our competitive position will be even worse when other foreign oil comes onto the market. A price increase would assure the most efficient use of these natural resources."

McCollum cites stocks . . . McCollum hammered hard at the need for more realistic control of high inventories, one of the major factors in depressing prices.

"The problem of short-term inventory management has become increasingly complex in recent years, largely because of fundamental changes in the seasonal pattern of demand," he stated in a paper entitled "Casting Up the Ledger."

"Not long ago," he continued, "the combined demand for all petroleum products was nearly constant throughout the year—the summer bulge in gasoline demand was approximately balanced by the winter bulge in heating-oil consumption."

The Continental president noted that in recent years gasoline sales have been nearly as high in the winter as in the summer. In the meantime, winter demand for heating oils has risen steadily. Now, demand for petroleum products reaches a "sharp seasonal peak' in January.

"The changes which have taken place in the seasonal pattern of demand are illustrated by the fact that this year the combined demand for all products in May was 15 per cent less than in January; 10 years ago in 1946, the differences between the 2 months was only 2 per cent.

"This seasonal downswing in mid-year demand must be taken into account at all levels of the oil industry, beginning with crude-oil production,"

he emphasized. "Unless this is done, excess stocks will accumulate, and the price structure for products, and perhaps even crude oil, may be undermined."

Gasoline situation . . . Reviewing the sharp climb in inventories this year, McCollum said "our competitive enthusiasms blinded us to economic facts." By June 30 of this year, he said, gasoline stocks were 20,000,000 bbl., or 12 per cent, higher than on the same date in 1955.

While gasoline demand has been up almost 5 per cent this year, refinery runs are up almost 7 per cent.

"It is not surprising, therefore, that the industry now finds itself with almost 24,000,000 bbl. more gasoline in storage than it had at this time last year," McCollum continued. "The summer is over, and there is little hope that these stocks can be brought to reasonable levels before the end of the year."

Role of imports . . . Pointing out that crude-oil imports have increased from 10.3 per cent of domestic production in 1954 to 12.4 per cent during the first half of this year, McCollum said that reliance upon foreign oil "involves varying degrees of risk."

"At the same time, however, I firmly believe that foreign oil can and should play an important role as a supplement to our domestic supplies," the Continental president stated.

In the distant future, he said, the nation probably will need all the domestic crude oil available and may have to supplement its supplies with increasing volumes of foreign oil.

Oil Demand to Soar

Rathbone sees 80 per cent increase in free-world demand for energy in 20 years, with oil's share getting larger

HOUSTON.—A long-range growth in petroleum demand which would create a shortage in the United States if its oil imports were cut off was predicted last week by M. J. Rathbone, president of Standard Oil Co. (N. J.).

Rathbone forecast a gain of nearly 80 per cent in the free world's total use of energy within the next 20 years. Between now and 1975 Rathbone expects oil to be called on to meet a growing portion of these energy needs.

The Standard of New Jersey president contends there is "every reason to augment our oil supply by reasonable imports."

"Otherwise," he stated, "at some distant day in the future, the United States will be short of oil as compared to other countries which are supplied by the relatively more ample supplies of the Middle East and elsewhere."

Great reserves remain . . . In a paper presented at the annual meeting of Texas Mid-Continent Oil and Gas Association, Rathbone pointed out that one estimate presented to the Joint Committee on Atomic Energy had placed ultimate oil reserves of the free world at possibly 900 billion barrels.

Since about 80 billion barrels of oil have been consumed, he pointed out that there may be another 800 billion barrels left to discover and produce.

"Here at home in the United States we will find much more oil—both in the older established areas as well as in some of the newer areas and offshore," he predicted.

"But, of all areas, the Middle East has by far the highest potential for future production. The recent major discovery in the Qum basin of Iran is an example of what can occur in the undeveloped areas of the Middle East at any time."

Rathbone stressed the improvement of recovery methods as a major source of future oil supplies. He pointed out that at present only about 30 per cent of the oil is recovered from the average field. He suggested the possibility of increasing the average to 45 per cent through research, improved technology, and sufficient capital investment.

Warning that federal controls of natural-gas production may lead to some degree of "federal interest" in crude-oil production, Rathbone said, "I can think of nothing which would tend to slow down the development of new oil reserves in the United States more than any degree of federal intervention in, or control of, oil production."

He predicted, however, that the "present natural gas situation will be corrected before too long."

Oil's energy role . . . In this estimate of the free world's energy requirements

OIL HUDDLE at Texas Mid-Continent Oil and Gas Association meeting in Houston finds Joe H. Russell, former president of West Texas Gulf Pipe Line Co., comparing notes with John Suman, Houston consultant and former Standard Oil Co. (N.J.) vice president, and Frank M. Porter, president of American Petroleum Institute.

TALKING SHOP at Houston session of Texas Mid-Continent Oil and Gas Association are R. D. Hanley, vice president and manager of Magnolia Petroleum Co.'s natural gas department, and his boss, Magnolia's president, J. L. Latimer.

Rathbone expressed total demand in terms of barrels of oil.

In 1935, he said, the free world used from all forms and sources of energy the equivalent of 20,000,000 bbl. per day. In 1955 the figure was 38,000,000. In 1975 he anticipates an equivalent demand of 68,000,000 bbl.

Oil's contribution to this energy rose from 21 per cent in 1935 to 38 per cent at present. Rathbone said the trend is expected to continue, with oil representing about 45 per cent of total energy in 1975.

"In the United States alone," he continued, "we anticipate oil demand here will be in the neighborhood of 15 million barrels daily by 1975, over two-thirds more than what it is today."

Imports defended . . . Speaking to nearly 1,000 fellow oil men, many of them independents strongly opposed to present competition from foreign oil, Rathbone staunchly defended "reasonable imports."

"On the other hand," he said, "it is surely true that if imports are permitted to reach a level which would impair the strength and virility of our domestic oil industry, we would be following a foolish and imprudent course." He said there is no "unanimous view" in defining reasonable imports.

He urged the limitation of imports by "voluntary action on the part of the importing companies—not by government control."

"Today, and probably for a good many years in the future, the United States could supply its own requirements solely from domestic production," he said. "And yet I do not think we want to do that. We should aim at having our own reserves go farther by reasonable imports. . . ."

New Tax Policies Urged

HOUSTON.—Further changes in the nation's tax policy to help business and the general economy were urged last week by two Texas Mid-Continent Oil and Gas Association speakers.

Secretary of Commerce Sinclair Weeks noted the 1954 federal tax bill was the first complete revision in the U. S. tax structure in 75 years. He added: "There's still something to be done in that area."

L. L. Colbert, president of Chrysler Corp., called the oil depletion provision "an excellent illustration of the way taxation can be used positively to add to the nation's total wealth." Pointing out that experts are preparing to review the nation's tax policies, Colbert said, "We can hope the Government will take due notice of the present speed of machine obsolescence and the high cost of replacement in shaping tax policy on depreciation."

Offshore Conservation Decided

California to decide unilaterally if injection programs needed; land commissioners to take Proposition 4 stand

LOS ANGELES.—Future offshore leases issued by California will contain a clause providing for compulsory secondary-recovery or pressure-maintenance operations.

The State Lands Commission, at its recent meeting here:

. . . Voted to give the state the right to order lessees to start such operations where, in the state's opinion, it would be in the best interest of the public.

. . . Reserved for the state the right to make the final decision on the need for conservation programs.

The new provision will be included in leases on two parcels the State Lands Commission agreed to put up for bonus bidding. One covers 5,500 acres in the Summerland area off Santa Barbara County, the other 5,600 acres offshore from the Ventura-Los Angeles county line.

The latter is in the middle of a block of three parcels totaling some 16,700 acres sought by the C.U.S.S. group (Continental, Union, Shell, and Superior). The commission voted against offering the entire 16,700 acres pending outcome of exploration on the middle 5,600 acres.

Company objections . . . C.U.S.S. argued that if drilling failed to turn up anything on the middle block, then those adjoining would lose their bonus bidding value.

The commission turned down the group's bid for all three parcels. Its reasoning: If the middle block does prove productive, than bonus and royalty features of the others will be greatly increased.

All three blocks are now classed as wildcat, meaning they will bring 12½ per cent royalty to the state. Royalty rate on areas located on known producing structures is on a sliding scale beginning at 16⅔ per cent.

Proposition 4 . . . At the same commission meeting cases were presented for and against Proposition 4, the controversial Oil and Gas Conservation Act on the November 6 ballot.

One commissioner, State Director of Finance John M. Pierce, declined to take a public stand because of his past association with the oil industry. The other two, Lt. Gov. Harold J. Powers and State Controller Robert C. Kirkwood, said they would disclose their views before the election.

In designing new Toledo plant . . .

. . . Sohio Breaks With Tradition

TOLEDO.—The new 60,000-bbl. per day refinery that Standard Oil Co. (Ohio) is designing for construction here will depart from tradition in several ways.

The innovations in refinery design include:

. . . An integrated refinery in one package. The new project will replace all existing facilities except two alkylation units and a rerun unit. The rest of the present plant will be put in "moth balls" for standby capacity. Included in this reserve are 28,000-bbl. crude distillation capacity, 8,000-bbl. thermal cracking unit, a 7,000-bbl. thermal naphtha reformer, a 7,000-bbl. delayed coker, and a 700-bbl. polymerization unit.

. . . Operations and controls. Adequate means for measurement and control of particular operations will be available to each individual in charge of various processing sections. These facilities covering both operating conditions and stream characteristics will be located within the area for which each individual is responsible.

Decentralization of controls will be selective. Those controls that are best decentralized will be located at a common control point while other controls will be placed at the most suitable locations. Also control of all work of a basically similar type will be assigned horizontally. For example, furnace control will be handled by a single authority regardless of process breakdown.

. . . Communications center for overall coordination of refinery. Critical portions of the operation requiring prompt correction in case of upsets will be controlled here. The exact status of any unit in the integrated refinery can also be determined at this center. All other controls will be decentralized to local authority.

The new facilities will include catalytic cracking, reforming, hydrogen treating, and coking.

Lease Law Attacked

Congress might be asked to revise regulations covering federal lands; hearings of subcommittee spotlight need

ALBUQUERQUE.—The next Congress might be asked to change the Mineral Leasing Act.

Indications of this came from Sen. Clinton Anderson, New Mexico, Democrat whose Senate subcommittee last week concluded a 10-day hearing here to investigate oil-leasing practices on government reserves.

"It is apparent," Anderson declared, "that operations under the act do not conform to the interpretation which I had placed upon the legislation. . . ."

He continued that it is also apparent that the oil industry as a whole is "somewhat uniform" in its interpretation of the law. This, he said, "would seem to indicate that Congress needs to tie down compliance with the law, as well as direct its enforcement by the appropriate agencies."

The oil industry apparently goes along with Anderson on the need for a change, but it is unlikely that they will see eye-to-eye with him on just what is needed. Some, if not all, would like to see the law abolished and have the leasing of federal lands placed on a competitive basis.

A spokesman for one major company summed it up this way:

"I think most operators agree that acreage limitations should be done away with. In order to make it economically feasible to carry out an exploration program, you have to put together sizable blocks. Competitive bidding is the best way to accomplish this."

Law may be eased . . . Oil men don't expect to end up with any such blessing, but Anderson brought out a point that carries hopes for favorable regulations if a new law is in the making.

"The hearings have established," he said, "that neither the oil and gas industry, the Department of Interior, nor Congress favor strong limits."

E. F. Bullard, president of Stanolind Oil & Gas Co., pretty well summed up oil's feelings in the matter when he declared that the differing opinions arise from "deficiencies in the law."

"We have high hopes," he added, "that out of this hearing will come constructive recommendations toward revising those provisions which are ambiguous or unrealistic."

He stressed that "under our interpretation, Stanolind has not and will not evade provisions of the law." Stanolind was the first of 13 companies to testify.

Interpretations differ . . . Anderson's interpretation of the law places the amount of federal land a company may hold under lease in any one state at 40,080 acres and the amount under option at 200,000 acres.

Oil companies generally contend that the limits are double that in both cases. They take the position that the 1954 Mineral Leasing Act applied to original public domain and that equal amounts can be held on land acquired by the Government since that time.

Neil F. Stull, a Washington, D. C., attorney, backed them up on this point. During testimony at the hearings, he cited an Interior Department ruling which, he said, supports this belief.

Stull also testified there are legal ways for a company to evade acreage limitations. He explained that on some occasions he had taken leases for clients in his own name, in the name of his wife, and others. The leases were then turned to companies on option.

The hearings brought out that this use of "straw men" is a common practice among companies for obtaining lease options. Anderson lumped this practice with others which he branded as "devices."

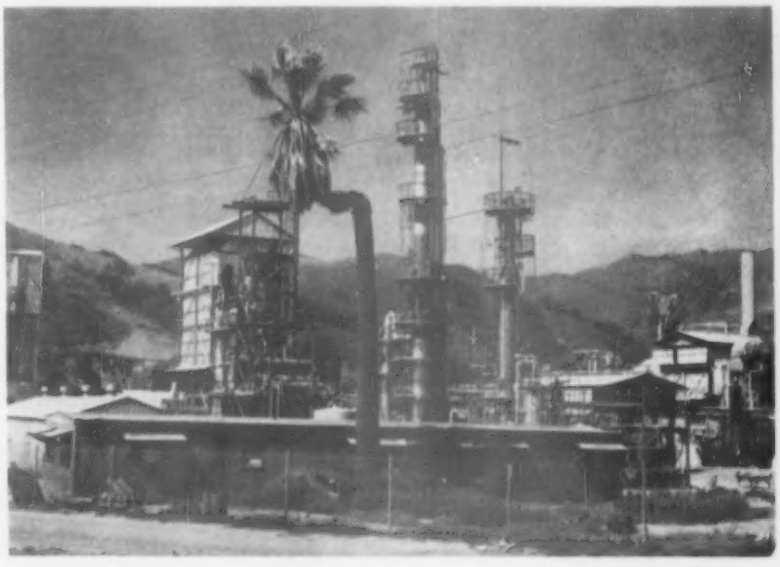
As the hearing concluded, Anderson announced he would like to have the views of the industry and invited companies to file statements on questions raised at the investigation. He listed some of these as:

. . . Should present provision of the leasing act, with reference to the taking or renewing of options be changed? If so, in what respect?

. . . Does the taking of successive options identical with the original option, except as to terminal date, avoid the requirement that options be not renewed?

. . . Should competitive bidding be used to a greater extent?

. . . As now construed and applied, are acreage limitations serving any useful purpose?



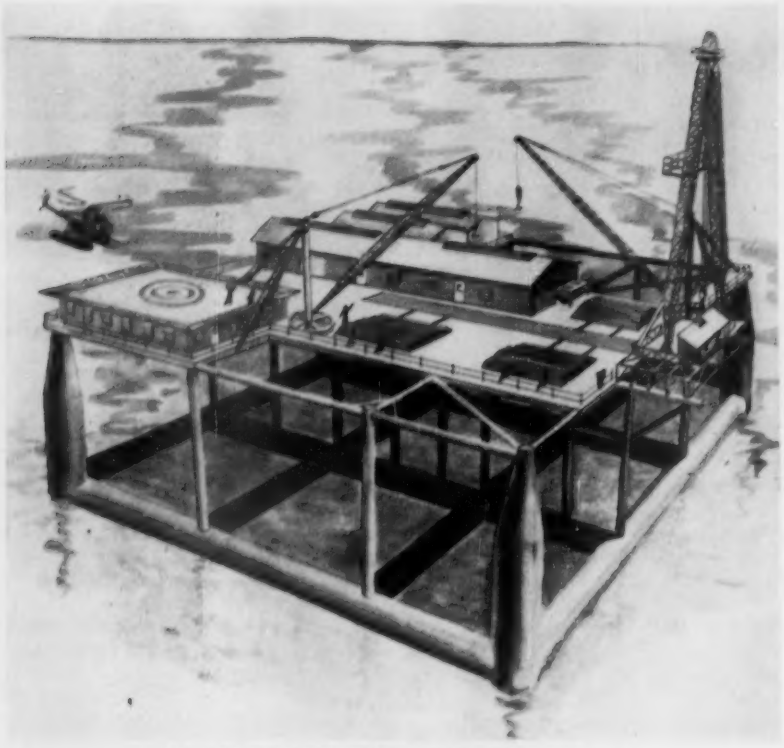
Urea Plant Nearing Completion

VENTURA, Calif. — Shell Chemical Corp.'s 100-ton-daily urea plant, the first to use the Italian Montecatini process, is nearing completion here. The installation adjoins the company's 175-ton-daily ammonia works.

Urea, made from ammonia and carbon dioxide, is used primarily in high nitrogen-content fertilizers *(The Oil and Gas Journal, January 2, page 48)*. Four other firms are already manufacturing the chemical at five plants. Two others are scheduled.

Plants in operation are Sohio Chemical Co. at Lima, Ohio, using the Swiss Inventa process; Du Point at Belle, W. Va., using its own process; Allied Chemical & Dye Corp., at Omaha, Neb., and South Point, Ohio; and the Grand River Chemical Division of Deere & Co. at Pryor, Okla., Allied and Deere use the Pechiney process.

Other urea plants are scheduled for Savannah, Ga., by Southern Nitrogen Co., and Kyrene, Ariz., by Thunderbird Chemical Co.



KERMAC RIG 46 offers some innovations for . . .

New Offshore Workhorse

● Radical mobile drilling platform of Kerr-McGee has a strange hull of latticed steel pipe, its new-type rig drills over the side from movable, cantilevered floor

PASCAGOULA, Miss. — A goliath mobile drilling platform—probably the largest built to date—will be put to work in the gulf next month by Kerr-McGee Oil Industries, Inc.

The rig is one of the most unusual to appear on the offshore-drilling scene. Here's what makes it unique:

. . . **A floating "hull"** made up of 14-ft. diameter steel tubes.

. . . **A cantilevered**, movable, double base for the rig which enables it to drill up to six wells over the side of the platform without moving the barge.

. . . **A new-type mast** which can double as a construction boom to build production platforms for completed wells without calling in a crane boat.

The rig is one of two identical units under construction for Kermac in the yards here of Ingalls Shipbuilding Corp. The first, designated Kermac Rig 46, will be commissioned October 24. The second—Rig 47—will be completed about a month later.

Both pieces of equipment are expected to become offshore workhorses in water up to 70-ft. deep and to strengthen Kermac's position as one of the leading offshore-drilling contractors.

It's different . . . Rig 46 has several radical features from top to bottom.

Hull of the deep-water drilling barge is like nothing ever seen on a seagoing vessel. It's more like a raft. Tubular steel 14½-ft. in diameter is welded into a rigid grid pattern 202 ft. long and 242 ft. wide. This provides the base of the barge.

Working platform is 100 ft. above the base and is connected to it by 26 supporting steel columns. Twenty of the supports are 42-in. diameter. Two are 48-in. steel columns. Stabilizing columns are at the four corners. They are 22-ft. in diameter for the lower 64 ft. and taper to a 5-ft. diameter on the upper 36 ft. They also extend about 6 in. below the bottom of the base.

The T-shaped deck is 181 ft. at its widest point and 228½ ft. at its longest point. Crew quarters and engine housing are located on the cross-bar of the "T." Drilling mast and draw works are at the base of the "T."

How it works . . . The unit is self-contained and requires no tender. It is towed to location. The tubular base is flooded, submerging the lower structure to the floor of the gulf.

The stabilizing columns on the four corners also are flooded. These, together with the tremendous size and weight of the structure plus its open framework, are designed to give the platform stability in rough weather.

In normal drilling opeartions, the mast, draw works, rotary table, and other derrick-floor equipment, and their supporting substructure do not rest on the deck. They sit on two large steel beams cantilevered 55 ft. beyond the edge of the deck. Drilling thus is over the side.

This unusual construction allows drilling of up to six wells without moving the barge. This is achieved because all the equipment on the cantilever can be skidded by hydraulic rams in two directions: Either 55 ft. away from the side of the platform or a distance of 46 ft. parallel to the side.

The mast . . . Another unusual feature of the rig is the drilling mast.

It is a two-piece, inverted "V" affair built by International Derrick & Equipment Co., consisting of a 14-ft. truss-type lower section and a 3-ft. deep girder-type upper structure. The lower structure spans the 46 ft. between the cantilevered beams. The upper piece is designed to be skidded on the lower structure. This gives new well locations along side of the barge. The lower structure then can be skidded on the cantilevered beams. This gives well locations away from the barge.

The mast also can be used as a construction boom. When put to this use, it is skidded back onto the deck, tilted, and the crown block is lowered and restrung to work with a crane. Capacity of the mast for this work is 125 tons. It can be used for setting well protection and production platforms for completed wells without endangering the construction when the barge is moved.

Other features . . . Air-conditioned quarters for 50 persons are provided in the single level structural steel house set on one edge of the deck. The house furnishes office, dining, sleeping, and recreation space. Its top serves as a helicopter landing port.

The rig is powered by three 875-hp. General Motors Electro-Motive diesel engines, each driving two 500-kw. generators. Auxiliary generating system consists of two Caterpillar 500-hp. en-

gines, each driving a 350-kw. generator. Pumps are two Emsco D-1000 each powered by two 625-hp. electric motors and 1 Emsco B-14 electrically powered for mud-mixing services. The Emsco double-drum draw works is driven by two 625-hp. unitized motors, and the rotary table is driven independently by a 625-hp. motor.

The string-up includes an Ideco crown block with seven 55-in. diameter sheaves, an Emsco traveling block with six 60-in. diameter sheaves, a 450-ton capacity Byron Jackson hook, and a 400-ton capacity Emsco swivel.

Its advantages . . . Kermac officials are proud of their new platform, which was designed by Paul Wolfe of the company's design staff.

They claim its chief advantages lie in its:

. . . Stability. This is achieved by sheer weight and size instead of using pontoons, jacks, caissons, or other devices employed on conventional mobile drilling platforms.

There are no moving parts in the substructure. Weight of the tubular steel—4,000 tons—plus the water taken on in submerging are believed sufficient to anchor the platform safely to the bottom of the gulf.

. . . Versatility. The rig can drill six wells from one location and can construct protection or production platforms for the completed wells before having to move off. Since drilling is over the side away from the substructure, there's no danger of damaging completed wells when the barge is moved.

Kermac officials declined to reveal cost of the platform and its equipment, but admitted no great economies were achieved in construction. However, the company is committed to the type of design revealed in Rig 46. An identical platform will be commissioned before the year is out, and a third unit, similarly designed for drilling in 45-ft. water, is planned.

New fields . . . When these units are all at work, Kermac will have ten offshore drilling units. It put a mobile platform into operation late last year and added a drilling tender unit earlier this year.

Kermac's total investment at midyear in drilling equipment was $15,868,305, including both marine and land facilities. The company's 18 land rigs were located in the Rockies, Oklahoma, West Texas and Gulf Coast.

Kermac recently revealed it also is considering entering the California offshore drilling field. Personnel has been put to work surveying drilling requirements on the West Coast. A decision on expanding there will be made when the present gulf expansion projects are completed.

watching WASHINGTON

. . . with Bertram F. Linz

Atomic tanker is rush project . . .

GOVERNMENT officials are anxious to get the atom-powered tanker perfected to take advantage of the current shipbuilding boom.

It is estimated that an average of 300 tankers per year will be built world wide over the next few years. If nuclear propulsion can show its advantages in the near future, much of this tonnage might be of that type. But if it isn't developed quickly, it might have to wait for another building wave.

The Maritime Administration and Atomic Energy Commission are working on designs for a test vessel. They may get one under way as early as the end of next year. Congress provided $42,500,000 last July to start the project.

Fuel cost of an atom-powered tanker today would be twice that of present engines. But the increased load, higher speed, and other factors would more than offset this, it is estimated.

The fuel cost of taking Middle East oil through Suez to Western Europe is roughly 9 per cent of the payload, according to oil company estimates. With nuclear power, a ship hauling 110,000 bbl. could use for additional cargo much of the 10,000 bbl. of oil now required for fuel.

Refiners to kick off space conquest . . .

MAN'S conquest of outer space will start next year. And the refining industry will kick it off.

The half-dozen satellites which will be launched from Florida during the 18-month International Geophysical Year, which begins next July 1, will depend on jet fuel for the first stage of their trip.

It will take an 11-ton, 3-stage rocket to get the 20-pound, 20-in. satellite on orbit, 300 miles above the earth. Jet kerosine will be the workhorse in an 8-ton motor that will get it off the ground and to a height of 35 miles and a speed of a mile a second in 2½ minutes in the first stage.

It's a guess whether the experiment will be a success. But even if it is, scientists designing the satellites see no need for refiners to rush into production of "space fuel." The payload will be only 1/10 of one per cent of total weight. Even if there were no equipment weight whatever except the fuel itself the payload would be only 4 per cent. So weekend excursion service to the moon just wouldn't be profitable for awhile.

Gas producers get new rules . . .

INDEPENDENT gas producers had better sharpen up their pencils. The Federal Power Commission has broadened its rules for filing rates and certificate applications and it wants more information than ever before.

An operator who is a party to the sales contract must now file all applications for participating producers in an operating unit. And he must include such additional information as his sales authorization or operating agreement. He will also have to file up-to-date annual reports showing whose gas he is selling.

Producers not signing sales contracts may not file. If the operator does not sign, a signatory participating producer must do the filing. In such cases, the latter may also file for other owners in the unit. Authorized participating producers are permitted to file even if the operator does so, but this is not required. If the operator is an interstate pipeline company which delivers gas into its own lines, it must list the names of all producers with the FPC. The producers must then make the required filings.

Percentage sales are also covered by the new regulations. The plant operator must make all filings required to cover sales by producers to the processing plant at a price which is a percentage of the proceeds from the resale of residual gas.

Sinclair Deal Near

Southern Production stockholders are expected to approve sale this week; proxy votes favor deal by 40 to 1 margin

FORT WORTH.—The sale of all production, refining, and pipeline properties of Southern Production Co. to Sinclair Oil Corp. appeared certain to go through without a hitch last week.

Southern stockholders are not scheduled to meet to vote on the $107,500,000 deal until October 11. But proxies have been flowing in steadily for the past 2 weeks. They favor the sale to Sinclair by a ratio of about 40 to 1.

Southern officials appear confident that approval already is in the bag and predict that the sale will be flanged up by about November 1. Final contract, financing, and tax details should be cleared away by then.

Sinclair will pay Southern $42,500,000 in cash plus $65,000,000 in production payments over the next 10 years.

For this outlay, it will acquire crude-oil reserves estimated by Meyer & Achtschin, Dallas engineering and geological firm, at 31,204,632 bbl., condensate and plant products reserves of 19,336,945 bbl., and gas reserves of 971,666,752 M.c.f. in the United States and Canada *(The Oil and Gas Journal, July 30, page 121)*.

Sinclair figures it will increase its net reserves (less those needed for production payments) by about 21,000,000 bbl. of liquids and 525,000,000 M.c.f. of gas. Sinclair's daily crude production will be hiked about 5,000 bbl.

The company also will acquire nearly 1,500,000 acres of nonproducing leases, mostly in Canada, and holdings in a large refinery and three pipelines.

Southern Production last year produced an average of 8,325 bbl. daily of oil, 2,722 bbl. a day of condensate and plant products, and 145,754,000 cu. ft. a day of gas. Most of this production came from Texas, with smaller amounts from Oklahoma, Saskatchewan, Arkansas, Louisiana, Mississippi, New Mexico, and Wyoming. The company owned 565 net oil wells and 88 net gas wells on 81,000 net producing acres.

Sinclair at the first of the year was producing 155,861 bbl. daily, while running 417,000 bbl. daily to its refineries. The difference between production and refinery needs was met through crude purchases.

The Southern properties will fit neatly into Sinclair's integrated operations and fill a need for more production and exploration potential.

Other holdings . . . Sinclair also will pick up via the deal Southern's 40 per cent interest in the 25,000-bbl. refinery operated by Great Northern Oil Co. at Pine Bend, Minn.

Other properties which will change hands include:

. . . A 40 per cent interest in Minnesota Pipe Line Co., which operates a 16-in. pipeline from Clearbrook, Minn., 256 miles to the Great Northern refinery.

. . . A 20 per cent interest in South Saskatchewan Pipe Line Co., which operates a 155-mile, 16-in. crude line from the Fosterton area in western Saskatchewan to Regina.

. . . And an 8½ per cent interest in Westspur Pipe Line Co., which recently completed a 174-mile, 12-in. and smaller system in Saskatchewan.

Southern Natural deal near . . . Meanwhile, Southern Production was moving on another front to dispose of its remaining assets to Southern Natural Gas Co., of Birmingham, Ala.

These include:

. . . Control of Offshore Co., which operates five mobile drilling barges in the Gulf of Mexico, 10 barge-mounted marsh rigs, and three land rigs. Southern Production owns 67,550 shares of Offshore, comprising 67.55 per cent of the total.

. . . Control of Frederic H. Harris, Inc., a New York marine-engineering firm.

. . . A $9,000,000, 6 per cent note.

. . . Rights to "Timcoat," a new pipe-coating process.

Southern Natural stockholders will vote at a special meeting October 16 on a proposal to issue 367,491 shares of company stock for these assets. The stock last week was quoted at about $35 a share. At that stock price, Southern Natural would be paying about $12,862,000 for the properties.

A Southern Production official said his firm has been given indication that the majority of Southern Natural stockholders will approve the purchase.

When both Sinclair and Southern Natural deals go through, he said, Southern Production will distribute proceeds of the sales to its stockholders and go out of business. Rights to the Southern Production Co. name will be held by maintaining the firm as a name-holding corporation.

Company officials emphasized that the company has no intention of remaining in the oil business to develop more production from scratch.

Other deals . . . Sinclair's purchase of Southern Production would be the third such deal within a little more than a year.

The company purchased American Republics Corp. in March of 1955 *(The Oil and Gas Journal, March 28, 1955, page 83)* and bought 30 per cent interest in Texas Pacific Coal & Oil Co. in August of this year *(The Oil and Gas Journal, August 20, 1956, page 115)*.

Line Start Planned

Canada's first big L.P.G. line is due for '58 finish

WINNIPEG. — Construction on the gathering system and main line for Canada's first major L.P.G. pipeline is expected to begin next year.

Canadian Hydrocarbons, Ltd., has a federal permit for its subsidiary, Hydrocarbons Pipe Line, Ltd., to build the line from Alberta eastward to Winnipeg and perhaps later to Lake Superior.

Dutton-Williams Brothers, Ltd., Calgary, is conducting engineering studies which must be completed before line plans are laid before the Alberta Petroleum and Natural Gas Conservation Board. Dutton-Williams and A. D. Little & Co., Boston, are consultants.

While the exact route has not been established, it is expected that the gathering system will form a grid in central and southern Alberta which will feed into the main line running through southern Saskatchewan and Manitoba to Winnipeg. The route will be roughly halfway between the present Interprovincial crude line and the Trans-Canada Pipe Lines, Ltd., gas-transmission system now under construction.

Preliminary design points to an 8-in. diameter pipe originally from the Edmonton, Alta., area to the Regina, Sask., market. From there to Winnipeg the line will probably be reduced to 6-in. Terminal points for delivery of products to bulk stations and refineries will probably be located at Edmonton and Calgary, Alta., Moose Jaw and Regina, Sask., and Winnipeg, Man.

Initial capacity is estimated at 10,000 to 12,000 bbl. daily. Products to be shipped include condensate, natural gasoline, butane, and propane.

Some of the gathering facilities and the main line into southern Saskatchewan will probably be built in 1957. The balance of the line would be completed in 1958.

First "Flood Frac" Inconclusive

MIDLAND, Tex.—The first "flood frac" job, the biggest well fracture treatment yet recorded, has hiked production of a Spraberry well southeast of here, but only moderately.

The production increase, on this first trial, at least, isn't large enough to cause any sudden rush to this particular type of well treatment.

The guinea pig well, Hanley Co.'s A-2 Driver in the Driver area of Spraberry Trend area field, last week was pumping 40 bbl. of oil and 15 bbl. of water daily. Prior to the treatment, it was down only 17 bbl. of oil a day.

The frac job, performed in July, consisted of 250,000 gal. of fresh water and 200,000 lb. of sand. Eight pump trucks using 4,500 hydraulic horsepower pumped the mixture into the well at 52 bbl. per minute against a pressure of 3,400 psi. Along with the pump trucks, the operation required two sand blenders and eight sand trucks *(The Oil and Gas Journal, July 30, page 123)*.

The treatment, which was carried out by Dowell Incorporated, was about 2½ times as large as previous record-holder —a 100,000-gal. job on a water-injection well in McCamey field, also in West Texas.

Hanley Co. estimated the treatment cost $14,000. This, a company spokesman said, compares with costs of about $7,000 for its conventional Spraberry treatment with 30,000 gal. of refined oil and 60,000 lb. of sand.

Test not conclusive . . . There is a possibility, however, that the huge water-frac method of treatment didn't get a fair shake in its first trial.

Frank Forsythe, district manager for Hanley Co., points out that there were five sets of perforations open in a Spraberry section topped at 7,767 ft.

He thinks it possible that the treatment would have hiked production more if the operation had been carried out in stages. Diffusion of fracing power to the five zones, he thinks might have had a sluggish effect, wherein frac sand accumulated in the fractures near the bore instead of being forced further into the pay.

An indication of this, he said, is that the well sanded up with frac sand following the treatment.

Another factor which may have had a depressing effect on results, Forsythe said, is that the frac water stayed in the hole for a considerable time during sand-cleanout operations during which a sand pump was stuck in the hole. He thinks this may have hurt the well.

The A-2 Driver now has been back on production for a little over a month. The water it is producing is frac water. Forsythe said about 4,900 bbl. of the roughly 6,000 bbl. of treatment water is still to be recovered.

Moose range due first test . . .

. . . Alaska Location Is Staked

ANCHORAGE.—Location has been staked to give the recently opened Kenai National Moose Range its first test.

Richfield Oil Co. is scratching out a pilot road, a 20-mile "cat trail," from the Anchorage-Kenai road to a tentative site about 18 miles northeast of the town of Kenai in the Swanson River area.

Kenai is located on the upper coast of the Kenai Peninsula. The test well is scheduled to go to 8,000 ft. or into the upper zone of the middle Jurassic sediments.

Richfield will probably call the test a wildcat, but it has all the earmarks of a stratigraphic. Spudding is set for February 7, 1957. But whether the date will be met will probably depend on progress of the new road, which might not get a permanent bed until after the spring break-up.

Cost of the hole is now estimated to run as high as $1,500,000. Several other majors in the area are believed to have contributed dry-hole money.

Interior Department opened 2,000,000 acres last July on the Kenai Peninsula, including 71,680 acres in the Swanson River area where Richfield will drill *(The Oil and Gas Journal, July 30, page 131)*.

Leases revealed . . . Richfield picked up 26 out of the 31 leases in the area for a total of 67,480 acres. The other five leases comprising 4,200 acres, are shared by Union Oil Co. of California and Ohio Oil Co.

The three companies worked out a unit agreement before the acreage was opened up. Richfield was named operator.

Standard Oil Co. of California will presumably be operator of a second unit on the peninsula. It holds a development contract in another area.

Line Plans Expand

Large commitments claimed for crude-products system

SALT LAKE CITY.—Northwest Pipeline Corp. plans to build a crude and products pipeline from the San Juan-Paradox basin area to Salt Lake City with initial capacity of 25,000 bbl. daily instead of 15,000 bbl.

Pipe for the 6, 8, and 10-in. system is scheduled to start coming out of the mills next February. The company expects to start construction next May and complete the line the following fall.

Northwest Pipeline, a subsidiary of Northwest Production Corp., reports it already has commitments for purchase of crude and products exceeding the originally planned 15,000-bbl. capacity. This includes 5,000 bbl. daily of crude for both Phillips Petroleum Co. and Western States Refining Co. refineries. A commitment for 8,000 bbl. daily of light products also is reported.

The pipeline is to start at Ignacio, Colo., location of the 300,000,000-cu. ft. gasoline plant of Pacific Northwest Pipeline Corp., parent company of Northwest Production *(The Oil and Gas Journal, July 30, page 129)*. This plant would be the source of light products.

The main line will consist of 80 miles of 8-in. and 300 miles of 10-in. Laterals 6-in. in diameter will link the booming Bisti and Aneth fields.

Sulfur Venture Protested

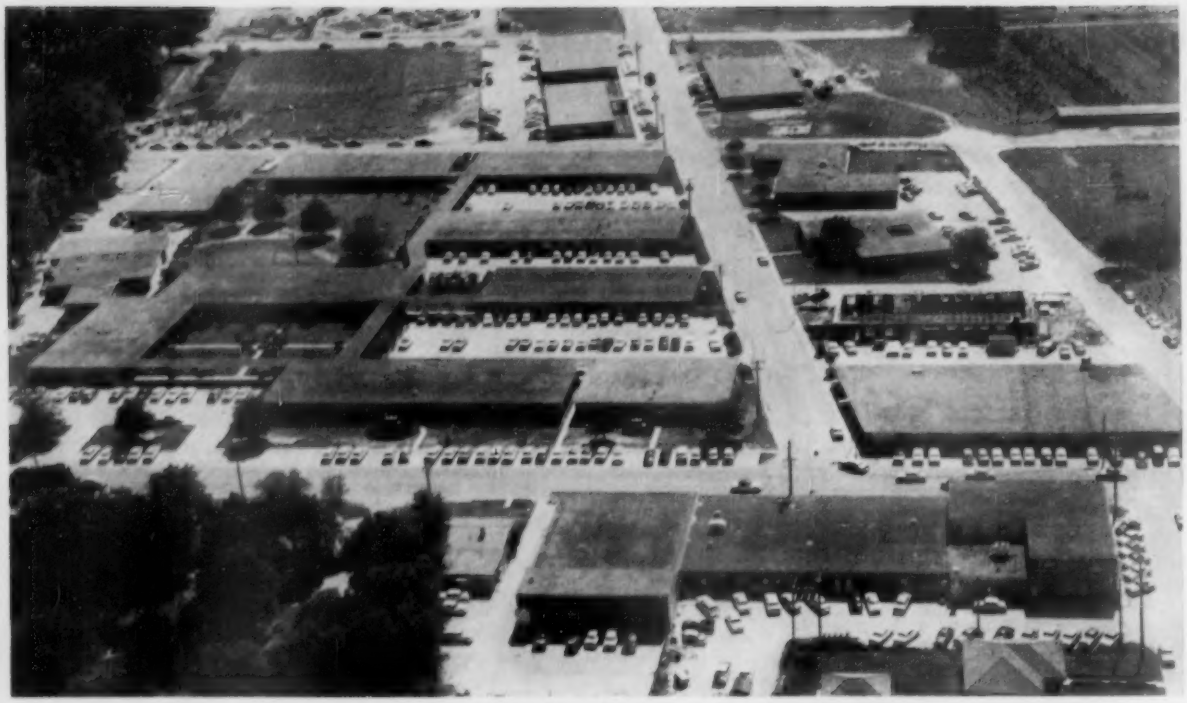
WASHINGTON.—The Gulf of Mexico's first open-water sulfur-mining venture has run into trouble with Washington's antitrust watchdogs.

A deal in which Humble Oil & Refining Co. would transfer large sulfur deposits about 6 miles off Louisiana, to Freeport Sulphur Co. has been protested by Sen. Joseph C. O'Mahoney of Wyoming.

The reserves, estimated at 30 to 40 million tons, are among the largest ever discovered *(The Oil and Gas Journal, October 1, page 68)*. Humble and Freeport would split profits approximately 50-50.

O'Mahoney asked Interior Secretary Fred A. Seaton to hold up approval of the deal, indicating that his subcommittee may want to take a closer look at the arrangement when Congress meets in January.

In a letter to Seaton, O'Mahoney charged that the transfer raises questions of "economic concentration." He pointed out that the principals are the subsidiary of "probably the largest oil company in the world" and "one of two largest producers of sulfur in the United States."



South Louisiana Spawns New Oil Center

LAFAYETTE, La.—The mushrooming Heymann Oil Center in Lafayette dramatically exemplifies southern Louisiana's oil boom.

Sohio Petroleum Co., one of the latest to move into swank offices here, held formal opening of its new district headquarters recently. More than 100 tenants in the oil business and related industries now have offices in the center.

Maurice Heymann, a local merchant, started building the oil center at the southeastern edge of the city in 1952 when new companies moving into southern Louisiana were hard pressed for office space. He hasn't stopped building yet.

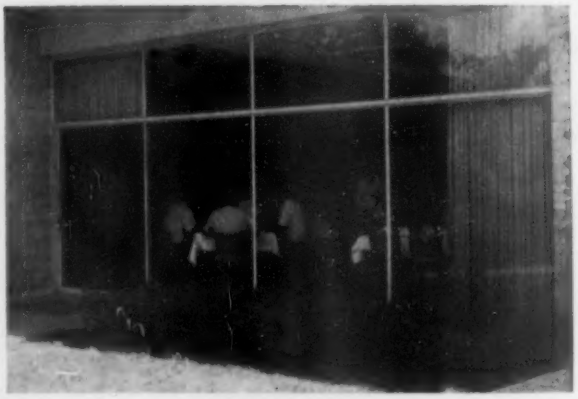
Original plans called for development of one block. Now 26 buildings are scattered over four oversize blocks, and Heymann estimates the center is about half completed.

Space in the oil center is available only to persons engaged in the oil business or in industries serving it. A small shopping center has been constructed on one side.

So far, oil companies have been expanding their staffs here faster than the developer could build offices for them. Two companies—Forest Oil Corp. and Ohio Oil Co.—built their own offices in the center. The remainder rent their quarters.

Heymann furnished the land for the modernistic Petroleum Club, which financed its own building.

When completed, the center is expected to occupy more than 2,000,000 sq. ft. Total cost is estimated at $7,000,000 to $8,000,000, including approximately $4,000,000 already invested.



With its own petroleum club . . .

. . . And offices in scenic setting.

New Superpremium Exceeds 99 Octane

Third-grade premiums not included in Ethyl survey

NEW YORK.—Superpremium gasoline, excluding third-grade premium, sold by three marketers showed research-octane ratings of 99 plus in seven cities on Ethyl Corp.'s monthly survey for September.

In New Orleans, two grades tested 99.7 and 99.9. Metropolitan New York listed one grade at 99.3, and Atlanta, Boston, Charleston, Houston, and Jacksonville each included a branded sample testing 99.0 or better.

Despite this influx of stepped-up premium ratings on the part of a few companies, the over-all weighted average on both premium and regular grades remained unchanged from August. They were 97.0 and 90.0 research octane numbers.

Ethyl is not yet testing samples of third grade superpremium gasoline in its monthly survey, so the ratings listed represent beefed-up premium brands replacing conventional premiums.

Six of the nine samples which ran 99 R.O.N. or higher were marketed by one company on the East and Gulf Coast. The same major also markets in the Great Lakes region and on the Pacific Coast, but has not raised its premium ratings there.

Two cities, Birmingham and Corpus Christi, showed premium averages of 98.2 in September vs. none for August. Salt Lake City stood low on the premium average, at 93.2 R.O.N. Otherwise, the distribution on premium grade showed little change.

PREMIUM

	Sept. 1956	Aug. 1956	Sept. 1955
90-90.9	0	0	1
91-91.9	0	0	0
92-92.9	0	0	2
93-93.9	1	2	5
94-94.9	3	2	7
95-95.9	3	1	18
96-96.9	19	21	11
97-97.9	25	27	9
98-98.9	2	0	0
Total	53	53	53
Avg. R.O.N.	97.0	97.0	96.0
Avg. TEL, ml./gal.	2.59	2.60	2.62

On regular-grade samples, Pittsburgh led with an average rating of 92.4 R.O.N., with Salt Lake City again in the low position with a regular-grade average of 82.2.

The spread between the weighted U. S. averages on regular and premium is still slightly smaller than a year ago (6.9 vs. 7.2 in September 1955). But the high-altitude cities showing low premium grade averages have closed the gap and the survey no longer shows regular grade in some cities exceeding premium in others.

REGULAR

	Sept. 1956	Aug. 1956	Sept. 1955
81-81.9	0	1	0
82-82.9	1	0	1
83-83.9	0	0	1
84-84.9	0	0	2
85-85.9	1	1	3
86-86.9	5	9	14
87-87.9	7	2	5
88-88.9	8	12	4
89-89.9	13	10	14
90-90.9	2	2	4
91-91.9	9	13	5
92-92.9	7	3	0
Total	53	53	53
Avg. R.O.N.	90.1	90.1	88.8
Avg. TEL, ml./gal.	2.31	2.38	2.30

Petrofina Buys Panhandle

NEW YORK.—American Petrofina, Inc., newly organized subsidiary of a famed Belgian parent, went on the board of the American Stock Exchange last week for the first time.

The new stock opened at 14⅞ after the infant company got its first growth by absorbing Panhandle Oil Corp. of Dallas. Panhandle stockholders will receive 1.3 shares of American Petrofina for each share of Panhandle.

American Petrofina, through which its international production, refining, and marketing parent is launching a bid for a share of business in this country, is now capitalized at $9,640,000. In the Panhandle deal it gained an 8,000-bbl. refinery at Wichita Falls, Tex.; 3,100-bbl. daily of crude production from 430 net wells, mostly in Texas; 90 bulk stations; and 250 retail stations.

Refinery to Be Liquidated

TULSA.—Tidewater Oil Co.'s refinery at Drumright, shut down since last year, will be liquidated. The company had tried unsuccessfully to sell the plant as a unit.

The Tulsa office of Heat & Power Co., Inc., of New York is preparing a catalog on the plant, which will be offered for sale piecemeal or as a complete operation. Equipment includes a 6,750-bbl. Houdriflow catalytic cracker; blending plant; 1,200-bbl. polymerization unit; 15,000-bbl. vacuum crude distillation unit; and a laboratory.

Tidewater officials announced early in 1955 that they were closing the Drumright plant "in keeping with the trend toward larger refineries."

Industry BRIEFS

Reiter-Foster Oil Corp. has bought a 75 per cent interest in 30 producing wells owned by Frontier Oil Co., Wichita, Kans., for approximately $1 million.

Addison Hayner, secretary of Reiter-Foster, said in New York that the near-700-bbl. daily production of the wells will boost his company's income by more than $360,000 a year after operating costs are deducted.

Blackwell Oil & Gas Co. of Tulsa has taken over the operation and name of Mul-Berry Oil Co. of Cushing, Okla. The stock-exchange deal gives Blackwell a total net crude production of 1,382 bbl. daily from 187 net producing wells in Oklahoma, Kansas, Texas, and Louisiana *(The Oil and Gas Journal, August 20, page 111).*

McRae Oil & Gas Co. of Midland, Tex., has moved into Oklahoma with the purchase of 38 wells in Southwest Mount Vernon field in Lincoln County. The $1,500,000 deal, with Davidor & Davidor of Oklahoma City, included 29 flowing oil wells and 9 gas wells. McRae will open an Oklahoma City office. Other offices are at Denver and Casper, Wyo.

Motor vehicle registrations this year will reach 65,275,000, a gain of 4 per cent over 1955. The greatest increases will be in Florida, Arizona, and Nevada, the Bureau of Public Roads predicted last week. Twenty-five states will show registrations of 1,000,000 or more vehicles. Leaders will be California with 6,557,000, New York with 4,819,000, and Texas with 3,959,000. But four other states, Illinois, Michigan, Ohio, and Pennsylvania, also will show more than 3,000,000 cars, trucks and busses.

Warren Petroleum Corp. and two affiliates have been cleared of charges that they restrained trade of L.P.G. in the Lake Village, Ark., area by cutting prices in 1952 and 1953. Charged with Warren were Butane Wholesale Gas Co. of Little Rock and Zero-LP Gas Co. of Lake Village.

The Federal Trade Commission ruled that Warren, although it owns 51 per cent of Butane's stock, does not control or direct the company and therefore is not responsible for its activities. It also held that Zero-LP, a Butane subsidiary, lowered its prices to meet competition and that competitors were not substantially injured.

Pipeline Clears Hurdle

Opponents of Midwestern-T.G.T. plan to bring Gulf Coast and Canadian gas to Midwest lose first round before FPC

WASHINGTON.—A scheme to build a pipeline bringing Canadian and Gulf Coast gas to the Midwest has survived its first test before the Federal Power Commission.

Opponents lost their bid for dismissal of the applications of Midwestern Gas Transmission Co., Tennessee Gas Transmission Co., and Iron Ranges Natural Gas Co. FPC Examiner Francis L. Hall recommended denial of the motions filed by 15 pipeline companies and coal and railroad interests. Exceptions to the examiner's finding must be filed within 20 days.

Tennessee Gas and its affiliate, Midwestern Gas, regarded the recommendation as an important victory in their plan to build a 2,000-mile pipeline system from Tennessee to the Canadian border. Iron Ranges is involved because it wants to build a line in Minnesota to handle gas it would receive from Midwestern.

Although the battle on the far-reaching project has only passed the preliminary skirmishing stage, Hall's decision rejected some of the intervenors' major points. He ruled that:

... The T.G.T.-Midwestern proposal is not a market raid as argued by entrenched pipelines.

... The companies have shown that they have the necessary markets and ability to finance the pipeline.

... Intervenors failed to show that planned sales to steel companies in the Chicago area would hurt local distributors.

... To throw out the project at this point would prevent a comparative hearing on plans by the T.G.T. firms and opposing pipelines to serve the same market area.

What is planned . . . Midwestern Gas proposes to build a $103,000,000 pipeline from Portland, Tenn., where it would tie into T.G.T.'s main system, to the Emerson, Man., terminal of Trans-Canada Pipe Lines, Ltd.

The line would have a daily delivery capacity of some 400,000,000 cu. ft. It would serve 125 communities in Wisconsin, Minnesota, Michigan, and North Dakota, as well as U. S. Steel Corp. and Inland Steel Co. plants in the Chicago area.

Midwestern plans to import 200,000,000 cu. ft. of natural gas daily from Canada and another 200,000,000 cu. ft. from T.G.T. at Portland. T.G.T. also would sell up to 48,000,000 cu. ft. daily to Trans-Canada at the New York border. This sale would be temporary to develop the Toronto-Montreal market pending extension of the Trans-Canada line from Alberta gas fields to Montreal.

Trans-Canada is now building the 574-mile Alberta-Winnipeg section which will be completed next year.

Opposition arguments . . . Principal challenge to T.G.T. and Midwestern comes from American Natural Gas Co. and the affiliated Michigan-Wisconsin Pipe Line Co. and American Louisiana Pipe Line Co.; Northern Natural Gas Co.; and Peoples Gas Light & Coke Co. and its subsidiaries, Natural Gas Pipeline Co. of America, Texas-Illinois Natural Gas Pipeline Co., and Chicago District Pipeline Co.

Some of their charges were:

... The Midwestern line would be an unwarranted invasion of their markets.

... A large part of the area would be made wholly dependent upon Canadian gas, contrary to past FPC policy.

Three subsidiaries of Peoples filed applications to provide 460,000,000 cu. ft. daily in increased capacity in the Natural Gas Pipeline system the day T.G.T.-Midwestern hearings opened. They seek to serve part of the same market.

Hall's decision . . . The FPC examiner suggested that the commission may want to reconsider its Canadian policy in the event Alberta's proven reserves are shown to be not only in excess of that nation's requirements but also sufficient to supply Midwestern's needs.

As to the raid, he declared:

"While counsel for American Louisiana and Michigan-Wisconsin properly asserts that 'aggression as a way of life has no place in the public-utility business,' he erroneously assumes (1) that a proposal to provide service not now being provided by existing pipelines constitutes aggression, and (2) that there is a showing in the record that Midwestern's proposed sales to U. S. Steel and Inland Steel will be harmful to the local distributors . . . .

"Furthermore, counsel completely ignores the fact that Michigan-Wisconsin itself was conceived and born out of an invasion of Panhandle Eastern Pipe Line Co.'s Detroit Ann Arbor market."

Hall said it could not be assumed, on the basis of evidence, that Midwestern planned to raid the franchise areas of distributors in the Chicago-Gary area.

"Rather, because its proposal to sell gas at wholesale to others in that and other areas in the Midwest was unacceptable to them, Midwestern presently seeks to obtain authorizations to render service not now being met from any other source."

He added that opposing pipelines cannot deny the existence of unsatisfied demands for natural gas in the Midwest beyond the proposed Midwestern capacity.

Noting that the pipelines refused to buy gas wholesale from Midwestern, the examiner said:

"It is because of this refusal and the known natural-gas deficiency in the area, that the chief executive officer of Midwestern and Tennessee testified that he feels free not only to solicit customers of existing pipelines but also of others in need of natural-gas service."

Wisconsin position . . . The decision also quoted from arguments of the State of Wisconsin and the Public Service Commission of Wisconsin.

These two parties to the hearings characterized their present service from Michigan-Wisconsin as essentially a stub-line service and called for a second supply in the future. They concluded:

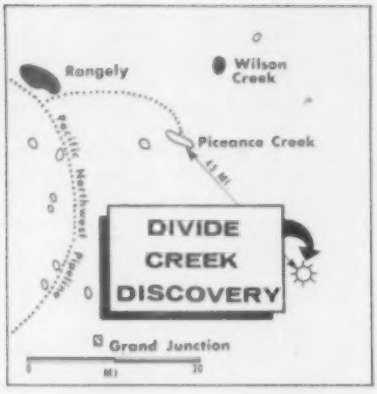
"Now we have made it plain . . . that our first choice for the second source of supply for natural gas would be Midwestern . . . "

Dow Buys Bay Refining

MIDLAND, Mich.—Dow Chemical Co. has bought two companies operating in nearby Bay City and will build a big ethylene plant there adjoining a 9,000-bbl. refinery acquired in the deal.

The purchased firms are Bay Refining Corp. and its affiliate, Bay Pipe Line Corp., both with headquarters in Saginaw. Dow exercised an option taken last June *(The Oil and Gas Journal, June 18, page 142)*. Management and operations of the two firms will remain unchanged. The pipeline company operates a system which draws supplies of crude from Canada and the U. S.

The ethylene plant, which Dow hints is only a start, is expected to be in operation by late 1957. Ethylene is a basic building block in the manufacture of Dow plastics, which accounted for 32 per cent of the firm's $565 million in sales last fiscal year.



Old Hole Produces

Rocky Mountain test hits gas on third drilling try

DENVER.—The third time proved to be the charm for Gordon Hurd's I Government in the Divide Creek area of Mesa County, northwestern Co'orado.

The well, first drilled 19 years ago, flowed at the rate of 6,160 M.c.f. per day on test of perforations at 4,126-40 ft.; 2,930 M.c.f. per day from perforations at 3,874-78, 3,885-90, 3,897-3,903, 3,912-21, and 3,928-33 ft. Tests were on 43/64-in. chokes. Hurd will perforate at 3,078-3,104 ft. in the Mesaverde for further tests before completing the discovery.

The location is on one of the state's biggest structures—a closure of 2,000 ft. or more and an area of 15,000 acres within the closure. It was first drilled in 1937-38 by Continental Oil Co. along with The California Co. and Amerada Petroleum Corp. Superior Oil Co. took it on down to 11,359 ft. in 1945.

The strike is 19 miles southwest of Glenwood Springs and 45 miles southeast of Piceance Creek.

Record Gas Well Reported

FORT STOCKTON, Tex.—Development of the Devonian pay at Puckett field in southeastern Pecos County has given West Texas its biggest gas well.

Phillips Petroleum Co.'s 2 Puckett had an open-flow potential of 578,000,000 cu. ft. daily. The flow is from the Devonian at about 10,750 ft. The well is near the center of this originally Ellenburger field.

Puckett field has a major fault along its western side, but otherwise is not defined. Recent completions have extended the field over a mile to the north. One of these, Phillips 2 Evelynjo, flowed at the rate of 370,000,000 cu. ft. of gas a day from the Devonian.

Pipeline BRIEFS

Clearing and grading of right-of-way is to start October 15 on the 750-mile pipeline system of Inland Natural Gas Co., Ltd., in British Columbia. Completion is scheduled for September 1957. Dutton-Williams Brothers, Ltd., has the contract for the project, which includes 350 miles of 4-12-in. main line and 400 miles of distribution lines in 31 towns and cities.

Main-line spreads will be Savona to Kelowna, Kelowna to Grand Forks, and Grand Forks to Nelson. Project manager is Pat Campbell with headquarters at Penticton. Between 600 and 700 men will be employed on the entire project. Inland will transmit gas from Westcoast Transmission Co., Ltd.

Southern Natural Gas Co. has Federal Power Commission authority to build 27 miles of pipeline to permit purchase of 50,800,000 cu. ft. daily from fields in Lafourche Parish, Louisiana. Southern Natural also will add 3,770-hp. compressor capacity on the $2,855,350 project. New gas suppliers will include Olin Gas Transmission Co., Lydia Bunker Hunt estate, H. L. Hunt, and Mississippi River Fuel Corp.

Stockholders of Houston Natural Gas Corp. have approved financing to acquire Houston Pipe Line Co. from Atlantic Refining Co. for $38,450,000. Of the total, $11,684,000 represents long-term debt of Houston Pipe Line. Atlantic recently acquired certain Houston Oil Co. properties in the $200,000,000 deal of which the pipeline firm was a part.

Hearings were scheduled to open today before the Federal Power Commission on competing applications by Lone Star Gas Co., Dallas, and Natural Gas Pipeline Co. of America, Chicago. Both propose to build pipeline facilities to supply Natural Gas Pipeline with additional gas. The reopened proceedings are to hear new evidence developed since an FPC examiner last February ruled for Natural Gas Pipeline and denied Lone Star's application.

Pacific Gas & Electric Co. is spanning the Colorado River at Needles, Calif., with a 1,080-ft. extension bridge. The firm will cross the river with 34-in. line, part of an addition to its Topock, Ariz., to Milpitas, Calif., gas transmission system. The new section will connect on the eastern side of the river with El Paso Natural Gas Co.'s supply line from West Texas and New Mexico. Fisher Contracting Co. of Phoenix is doing the work on the $35,000 bridge.

A 1,675-ft. extension bridge is going up over Peace River at Taylor Flats, British Columbia. It will carry Westcoast Transmission Co., Ltd.'s big pipeline which will move Peace River gas to the Washington border. About half the 680-mile line is in.

Contract for the aerial crossing is held by Pipeline-Bridge-Foundation, a joint venture by Marine Pipe Dredging, Ltd.; Marwell Construction Co., Ltd.; British Columbia Bridge & Dredging Co., Ltd.; and Iroquois Constructors, Ltd.

New pipeline facilities to cost $11,011,000 will be built in the Chicago area by Texas Illinois Natural Gas Pipeline Co., Chicago, and Chicago District Pipeline Co., Joliet, Ill. The Federal Power Commission authorized Texas Illinois to build a 30-in. loop along its 20-in. line extending 38 miles from Joliet to Chicago District's 30-in. line in Chicago. Cost will be $6,411,000.

Chicago District plans 14.1 miles of 36-in. from the Howard Street line to make a new connection with Peoples Gas Light & Coke Co. and Northern Illinois Gas Co. Cost will be $4,600,000. The FPC said the new delivery point would increase the daily capacity of Peoples' system by almost 50 per cent.

Also for Pipeliners . . .

Sinclair will acquire an interest in three pipelines when purchase of Southern Production is completed . . . Canada's first major L.P.G. pipeline will be ready in 1958 (P. 120) . . . Pipe will start coming out of the mills next February for crude-products pipeline planned from San Juan-Paradox basin area to Salt Lake City by Pacific Northwest affiliate (P. 121) . . . Midwestern-T.G.T. proposal to bring Canadian and Gulf Coast gas to Midwest market clears strategic hurdle as motions to dismiss application are denied by FPC examiner (P. 124) . . . Iraq Petroleum will bypass troublesome Lebanon with 24-in. line to Banias, Syria (P. 128) . . .

PLUS THIS TECHNICAL FEATURE: Chart for calculating power costs, time saving with paraffin cutter, and oil-transfer pump used in pigging (P. 273).

New Imports Plan Ready

Flemming to disclose decision this week, he's expected to change basis for figuring whether imports excessive

WASHINGTON.—A new decision on limitation of oil imports will be disclosed this week by Mobilization Director Arthur S. Flemming, provided conflict does not arise in the Cabinet Fuels Committee.

Date for the hearing on domestic producers' plea for formal restrictions under the national security clause of the Trade Agreements Act will be announced at the same time, ODM officials promised.

The new plan is expected to follow substantially the formula set up in the cabinet committee's report in February 1955. There has been no shift from the basic philosophy then expressed, that imports must be restricted if the domestic industry is to remain strong and active.

"We are convinced still that if imports are not held to approximately the 1954 relationship (with domestic production) we are running a real risk of reducing incentives for exploration and production," a top mobilization official said.

New base . . . This would indicate that the question may be dealt with by changes in the bases on which imports are figured.

Over the past year these have been changed by taking out Canadian and Venezuelan imports and imports into the West Coast. The new program also will take out residual fuel, dealing with it separately.

Officials said there was no question about the need to keep imports down. The best way of doing that is the problem needing solution.

Some differences . . . Formal announcement of whatever new plan Flemming has will be submitted to the cabinet committee before being made public.

Intimating that there have been some differences of view in the committee, an ODM spokesman said that if there is any disagreement with the plan the issue will be thrashed out at another meeting between Flemming, the committee, and its task force.

Reports from importing companies on their fourth-quarter programs have been received in the ODM but not completely analyzed. Officials said, however, there is definite indication that import schedules have been trimmed. They could not say whether the cuts would meet Flemming's request last June that last-half imports be held to 4 per cent below those of the first 6 months.

The hearing on the producers' application is expected to be held before the end of the month. But Flemming, testifying last week before a House subcommittee, emphasized that his responsibility will be limited to finding whether he "has reason to believe" that imports threaten the national security.

His affirmative finding would go to the President, who then shall order an immediate investigation to determine the facts. If they support Flemming's report, the President can take such action necessary to correct the situation.

"Only the President is authorized to determine that there is a threat and what means should be employed to meet it," Flemming testified.

Test Hits 40 Miles in Gulf

LAKE CHARLES, La.—California Co. reports the discovery last week of another far offshore field in the Gulf of Mexico.

It is 40 miles from land, off Cameron Parish, southwestern Louisiana, and more than 25 miles from the nearest field. Location is in Block 160, East Cameron area, in federally owned waters. It is the company's initial test on its OCS Lease 0541.

The discovery well is productive of gas and condensate from Miocene sand perforated at 8,664-8,700 ft. Completion flow through $\frac{7}{8}$-in. choke was at the rate of 2,022,000 cu. ft. of gas and 43 bbl. of 52°-gravity condensate per day. Pressure was 3,500 psi. The hole was drilled to 11,193 ft.

"Detroit" Case Bounces Back

WASHINGTON.—The long-fought Standard Oil Co. (Ind.) "Detroit" case is headed for another round in the U. S. Supreme Court.

The Department of Justice has appealed the decision of the Chicago Federal Court of Appeals to toss out the Federal Trade Commission's "second round" case attacking the good-faith defense offered by Indiana Standard. The company was charged with discriminating in price between customers in the Detroit area.

The same Chicago court originally upheld the FTC's order holding that Indiana Standard had violated the Robinson-Patman Act. The company carried the case to the Supreme Court, which in 1951 upheld the good-faith defense.

In taking the case to the high court for the second time, the Justice Department soft-pedaled the good-faith issue. Instead, it contends the company should have dropped its policy of selling to certain jobbers at the tank car price when the Robinson-Patman Act was adopted in 1936.

Tidelands Near Miss

Louisiana's offer "almost" acceptable to Government

WASHINGTON.—Louisiana officials and the Interior Department inched another step closer last week to an agreement which would permit resumption of drilling activities in Louisiana's disputed offshore area.

A new proposal submitted by the state following a meeting at the department last month proved "not quite" acceptable to federal officials. But it was indicated that objections were aimed at points of less than major importance, although matters on which Washington is not willing to yield.

Meanwhile, the Supreme Court this week will get down to the business of the 1956-57 term. It will announce its action on a number of motions filed since it recessed last June, possibly including the motion of Louisiana to dismiss the Government's suit to limit the state to a 3-mile boundary in the gulf.

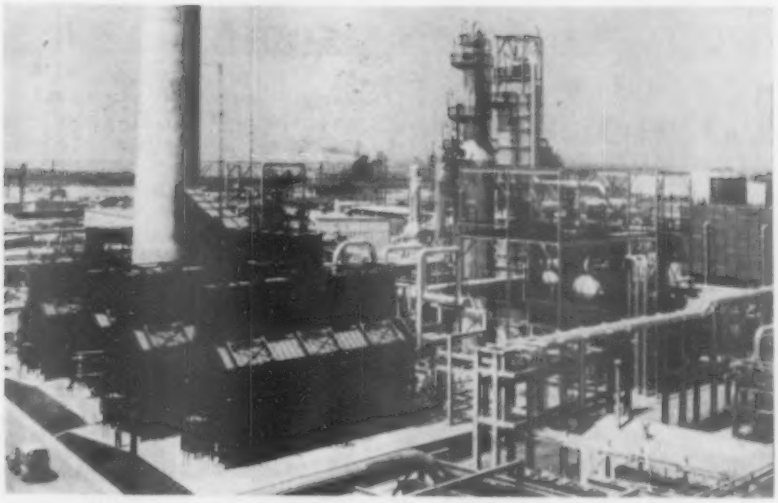
If the court orders the boundary suit to go ahead it may reach it for argument sometime after the middle of next month. The intervening time would be required for the filing of briefs on which arguments would be based.

Red Tape To Be Streamlined

WASHINGTON.—A committee from the oil industry will sit down soon with government representatives in an attempt to reduce red tape of government reports.

John W. Boatwright of Standard Oil Co. (Ind.) will be chairman of the group. Other members will be appointed this month. The committee has been created by the advisory council on federal reports, a Budget Bureau agency assigned the job of riding herd over government demands for information from industry.

The committee will have two objectives: Revising the statistical reporting programs of the Census Bureau, Tariff Commission, and other agencies to cut industry's burden of paperwork. And improving the statistical reporting to make it more useful to the oil industry.



Hydrodesulfurizer Kicks Off Expansion

AVON, Calif.—A big 2-year expansion program designed to boost gasoline output by 30 per cent, is beginning to shape up at Tidewater Oil Co.'s 114,000-bbl. Flying A refinery near here.

This 24,000-bbl. hydrodesulfurizer has just gone on stream and two other major units are slated for completion by the end of the year. They are a gas-processing plant and the world's largest fluid coking plant. The latter's 42,000-bbl. capacity will be four times larger than any now operating.

Smaller units already completed under Tidewater's 1955-56 beefing-up plan includes additions to the fluid cat cracker, additional emergency depressuring facilities, and new devices for removing possible effluent water contaminants. Bechtel Corp. of San Francisco is contractor on the projects.

Military Alkylate Pool Grows

WASHINGTON.—The Defense Department next year will have first call on well over 25,000 bbl. daily of alkylate from plants built with government assistance.

With the 55,000-bbl. daily capacity built with private funds under the expansion program of the Office of Defense Mobilization, the country will have a potential output of more than 80,000 bbl. daily of alkylate.

The Defense Department plants are built with the aid of an $80,000,000 revolving fund granted by Congress some 5 years ago for the purpose of developing capacity for military use. The contracts provide that the Government will either take the output of the plants, reimburse the companies for the cost of keeping them in standby, or permit them to dispose of their alkylate elsewhere.

As the department recovers funds advanced it can use them for additional plants. As of last June it had $49,000,000 available, including recoveries, practically all of which was committed.

Nine plants have been contracted for under this program. The last two will be completed this year. The design capacity of the plants is 22,670 bbl. daily. But four of them built in 1953-54 are producing in excess of design capacity, and others undoubtedly could do so if necessary.

While four of the plants are producing above design capacity and one other at that level, one plant is not producing for the Government and another is working below capacity because of insufficient feed materials.

The two plants now under way will be the largest in the program. Texas Butadiene & Chemical Corp. is building a 5,500-bbl. plant at Sheldon, Tex., and Tidewater Oil Co. is building a 4,280-bbl. plant at Delaware City, Del. These quantities of alkylate will yield an estimated 12,350 bbl. daily of Grade 115/145 aviation gasoline.

Plants built . . . First contracts under the program were made in fiscal 1952. Eastern States Petroleum Corp. built a 2,200-bbl. plant at Houston. DX-Sunray Oil Co. a 2,100-bbl. plant at Duncan, Okla., and Pure Oil Co. (Globe Oil & Rig) a 1,500-bbl. plant at Lamont, Ill.

Three contracts in fiscal 1953 give the department 1,500-bbl. plants by Ohio Oil Co. at Robinson, Ill., and American Mineral Spirits Co. at Toledo, Ohio, respectively, and an 1,800-bbl. plant by Cosden Petroleum Corp. at Big Spring, Tex.

Only one contract was made in fiscal 1954, with the McMurrey Refining Co. for a 2,240-bbl. plant at Tyler, Tex. No plants were added in fiscal 1955.

The most pressing need for additional alkylation capacity now appears to be in the Pacific Northwest. Efforts are being made to get new plants in that area.

Amortization Snag

Decision on tax write-offs for steel awaits ODM draft

WASHINGTON.—Steel is going to have to wait a little longer for a decision on tax write offs. And there may be still other delays ahead.

Mobilization Director Arthur S. Flemming has disclosed that a ruling on whether to set up expansion programs for oil-country tubular goods and steel plate has been put off until the Defense Department comes up with new mobilization requirements now being drafted.

The new figures, if tied to the budget the President will send Congress in January, should be available some time between the middle of December and January 15, Flemming said.

But if the draft is not finished in time for the figures to go into the budget, there may be still another delay in deciding whether there is a need for the expansion programs.

Projects for more than $1.3 billion in new steel facilities have already been submitted to the ODM in anticipation of a new expansion. These include plants for production of tubular goods, plate, structural, and other products.

Part of Texas Unit Sold

DALLAS.—General American Oil Co. of Texas has bought roughly a 5 per cent interest in big Cogdell Canyon Reef field of West Texas from D. D. Feldman Oil & Gas for $8,750,000.

The Cogdell Canyon Reef unit takes in more than 400 wells. The deal also includes four wells producing from the Fuller sand, which isn't unitized.

General American said payment will be partly by cash and partly by reserved production payment. The company added that after the properties are paid out, General American's interest will be subject to certain net-profit royalty interests.

I.P.C. Skirts Lebanon

● New 24-in. loop will go through Syria exclusively as result of heavy Lebanon demands; line to increase Iraq crude flow to Mediterranean by 180,000 bbl. daily.

IRAQ PETROLEUM CO. will build a 24-in. loop in its Middle East pipeline system into Banias, Syria, instead of Tripoli, Lebanon.

The I.P.C. move, announced last week, served notice on Lebanon that it has stalled long enough on the question of how much I.P.C. should pay for oil moved across a relatively few miles of Lebanon's territory.

I.P.C. has long been embroiled with Lebanon on how much the pipeline toll across the little eastern Mediterranean country should be. Last week I.P.C. said it had had enough. The British, Dutch, French, and American-controlled company said it will bypass Lebanon on its 24-in. expansion of the pipeline system. The line will miss the small corner of Lebanon that the existing 12-in. and 16-in. lines cross and move through exclusively Syrian territory to the port at Banias.

The new 24-in. line will move an additional 180,000 bbl. daily of Iraq crude into the eastern Mediterranean port of Banias, Syria.

There tankers can load the oil and move to Western Europe without passing through the troubled Suez Canal.

The present I.P.C. system moves Kirkuk crude across Iraq, Syria, and Lebanon. The system branches with one main line moving to Tripoli, in Lebanon, and the other into Banias in Syria.

Dispute deadlocked . . . The Lebanese Government has insisted on a base of pipeline tolls which the company regards as unrealistic. Lebanon rejected any possibility of arbitration of the dispute last week. A short time later I.P.C. made its "bypass" announcement.

Lebanon, with 20 miles of I.P.C. line crossing its territory, has demanded to be paid on a dollar-for-dollar basis with Syria, which has 263 miles. Lebanon now receives about $1,100,000 a year from I.P.C.

The new Syrian agreement boosted that country's revenue to more than $18 million a year with an additional $23,800,000 granted for back claims. Lebanon refused to accept the ton-mile formula on which the Syrian agreement was negotiated *(The Oil and Gas Journal, July 9, page 75)*.

I.P.C. gave the Lebanese until October 1 to agree to arbitration of the dispute.

In anticipation of the bypass action on the part of I.P.C., Lebanon passed a new law retroactive to 1952, which would make I.P.C. subject to internal income taxes—an exemption granted the oil transporting operation by its original contract with Lebanon *(The Oil and Gas Journal, July 30, page 138)*.

Lebanon earlier threatened to seize I.P.C. installations if the company diverts the flow of Iraq oil around Lebanon. The government said a 1931 agreement gives Lebanon the privilege of claiming the properties at any time if the I.P.C. pipeline operation is halted.

Firms Pool Assets

Independents plan new moves in U. S., Venezuela

A GROUP of American independents who have entered Venezuela on two fronts in the past few years by purchasing small-scale production last week put their eggs in one basket and said they're ready to expand.

Cecil V. Hagen, Houston, president of Venezuela Syndicate, disclosed that the company has acquired all the assets of Talon Petroleum, C.A.

Hagen is also president of Talon and the two companies are controlled by virtually the same interests.

Hagen, Roy B. Kelly, Washington lawyer, and Clint W. Murchison, well-known Texas independent, bought a controlling block of stock in Venezuela Syndicate just a little more than a year ago.

Its major holdings consist of royalty on 795,000 acres held by Mene Grande Oil Co. (Gulf) and 71,341 acres held by Cia. Shell de Venezuela. The company also has producing royalty in both East and West Texas. It is receiving about 900 bbl. daily in royalty oil from eastern Venezuelan wells.

Plans, production . . . Hagen said the consolidation is the first step in a major expansion program both in Venezuela and the United States. Venezuela Syndicate is taking over bids which Talon has already submitted for new exploration concessions in the Lake Maracaibo area.

Talon's oil production in Venezuela in August was 2,988 bbl. daily from Mene Mauroa, Media, and Hombre Pintado fields northwest of Lake Maracaibo in the State of Falcon in western Venezuela. The daily average production for 1956, up to and including August, was 2,470 bbl. daily.

Reds Open Rail Link

Line connects main China system to important field

A RAILROAD linking an oil field on the edge of the Gobi Desert with the main rail system in Central China has removed one of the big bottlenecks in Red China's oil history.

The line, located in Tsinghai Province, connects Lanchow with the oil town of Yumen, 500 miles northwest. It will permit stepped-up production in a region where output has been held down because of a lack of transportation facilities. The field is believed to be the biggest in China.

The Communists have pushed construction of the one-track road since they came to power in 1949. The line is counted on to speed the transportation of heavy equipment and workers to the area, as well as to take crude out.

The government plans to eventually push the line farther northwest across Sinkiang Province and into Siberia, where it would connect with Russia's Trans-Siberian railroad. The route would pass near several areas in Sinkiang where the Reds say they have made important discoveries *(The Oil and Gas Journal, August 13, page 103)*.

Development of Yumen field has gone on since 1939, when Nationalist Chinese began drilling. The work was continued during World War II.

Germany to Get Refinery

The German refining company, Ruhrbau G.m.b.H., (owned 75 per cent by Belgian Petrofina and 25 per cent by Farbenwerke Bayer) will build a refinery with an ultimate capacity of 42,000 bbl. daily in Duisburg, Germany.

There has been no official announcement from the company, but a town official of Duisburg last week said the refinery will go into operation by 1958 with an initial output of 20,000 bbl. daily.

More Guatemala Rights Granted

Houston independent stakes location for first wildcat; all concessions expected to be approved within a month

NEWS of additional exploration concessions being run through the government mill flowed out of Guatemala in a steady stream last week.

Most are not yet official—that is, they have not yet been published in a presidential decree. But it is just a matter of time until all 22 companies certified in June are awarded rights. All overlaps have been resolved and the official paper work is all that remains. This is expected to be completed within 30 days, meaning actual exploration will get under way on some tracts this year.

First wildcat staked . . . Story J. Sloane, Houston, has staked location for Guatemala's first test near Morales along the Honduras border.

The concession lies on the Motagua River.

Oil companies have their work cut out for them in exploring the dense jungle. Operators have estimated the outlay for a wildcat would run up to $1,000,000 and perhaps as high as $2,000,000.

New concessions . . . Several concessions in various stages of approval were disclosed last week in passing from one government bureau to another.

Union Oil Co. will receive rights on 145,835 acres in southern Peten. Seaboard Exploration Co., Chicago, will have a farmout on 5,000 hectares of the block in a 50-50 deal.

Amerada Petroleum Corp. of Guatemala will receive 218,852 acres in Central Peten. Amerada will grant one-third interests to Continental Oil Co. and Ohio Oil Co., its partners in Conorada Petroleum Corp.

Texas Petroleum Co. will be operator of group controlling 1,336,758 acres in northern Peten, holding 44.98 per cent interest while Sun Production Co. will have 27.07 per cent, Tidewater Guatemala, Ltd., 22.53 per cent, and Guatemala Atlantic Corp., 5.42 per cent.

Geophysical exploration is slated to start before winter.

Title to part of the big block will be in Texas Petroleum's name and the rest in Sun Production's. The government holds companies which receive the actual title responsible for carrying out obligations. It does not recognize the various arrangements worked out by several companies whose applications overlapped.

Concession processing . . . Although overlaps have been resolved for sometime, there are a number of steps which the government must take before officially granting title to the companies. The steps are:

. . . Certified companies file applications with the Department of Minerals.

. . . Minerals officials certify to the minister of economy that the applicant is qualified.

. . . The economy minister in turn certifies the application to the president, at which time it is published in the official diary.

. . . The president has 2 weeks to act on the application. It doesn't become official until he issues the decree granting the rights and the decree is published in the diary.

Shell Joins British Refining Push

SHELL PETROLEUM CO. last week joined the parade of major English refiners who plan to add another 220,000 bbl. daily to the United Kingdom's refining capacity by 1958 at a total cost of more than $178 million.

Shell will add 80,000 bbl. daily to the distillation capacity of its Shell Haven refinery in the Thames Estuary about 40 miles from London. The added crude unit will boost the refinery's capacity to about 150,000 bbl. daily.

E. B. Badger & Sons will build the new unit, which is designed to use one of the biggest furnaces in the oil industry.

The project will cost an estimated $18,200,000. It is obviously aimed at fulfilling Britain's zooming fuel oil demand.

Other United Kingdom refining projects already under way include:

. . . 50,000 bbl. daily in net crude-distillation capacity being added to Esso Petroleum Co., Ltd.'s refinery at Fawley. Already the largest in the U. K., the refinery's capacity will be 200,000 bbl. daily by the end of 1958 *(The Oil and Gas Journal, July 30, page 136).*

. . . 50,000 bbl. daily net distillation capacity for British Petroleum Co., Ltd.'s Kent refinery on the Isle of Grain.

This $73 million expansion program includes the addition of 90,000 bbl. in distillation capacity, a 10,000-bbl. catalytic reformer, a 10,000-bbl. thermal reformer, and two 10,000-bbl. Hydrofiners.

New plant planned . . . A 40,000-bbl. refinery, complete with all processing units, is planned for the south of England by Regent Oil Co., one of Great Britain's major marketers.

This will be Regent's (The Texas Co. and Standard Oil Co. of California) first entry into the British refining field.

Podco Quits Test

New wildcat set, shows in first prove noncommercial

PHILIPPINE OIL DEVELOPMENT CO. (Podco) has abandoned the first wildcat in the intensive exploration campaign in the Cagayan Valley of northern Luzon after oil and gas shows were noncommercial.

Podco plans a second test to the west of its 1 Tumauini shortly after the first of the year.

Extensive tests were made of gas zones from 2,990 to 4,196 ft. The operator experienced crushed casing trouble deeper in the hole.

The test, spudded January 12, was drilled to 10,414 ft. without reaching the Oligo-Miocene objective. Company officials now believe it was staked about 17,500 ft. to the east of the crest of the Tumauini structure.

On the basis of new geological data, Podco expects to find the Oligo-Miocene at 13,500 ft. in the second wildcat.

Casing has been ordered as well as two new diesel engines and high-capacity mud pumps for the next drilling operation. Podco was forced to suspend the first test at total depth because of mechanical difficulties.

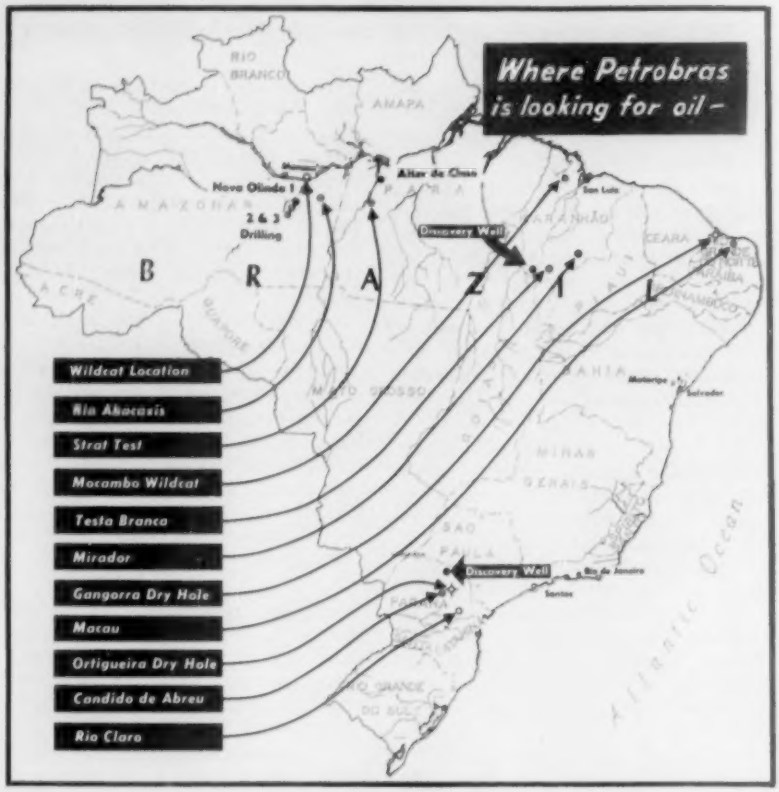
Contractor on the well was Kern International Co. It was drilled 25 miles from the northeast coast of Luzon in the province of Isabella. It is in an area where Podco, Standard Vacuum Oil Co., and California Asiatic Oil Co. and Texaco Overseas Petroleum Co. have large concession holdings.

Podco, headed by Andres Soriana, Philippine industrialist, has cross option agreements with both Stanvac and the Caltex companies calling for participation in the exploration effort if commercial oil is found.

Stanvac expects to begin its first test in the same region sometime early in 1957.

Brazil Starts Exploring Vast Region

● Petrobras tackles area bigger than U. S. with the budget of a medium-sized American firm



BRAZIL has launched a determined bid to narrow the gap between its production and demand for crude oil.

That gap is a wide one. Production is only 7,000 bbl. daily against a demand of 165,000 bbl. daily. And the problem of becoming self sufficient in petroleum will grow rather than diminish. Demand, if it continues to increase at its present rate, should reach 264,000 bbl. daily by 1958.

So it is a long uphill battle at best that is ahead of Petroleo Brasileiro, S.A. (Petrobras), the government company in whose hands Brazil has placed its oil future.

The magnitude of the task is pointed up by the fact that Petrobras has an area greater than the United States to explore with very limited capital resources. The Amazon basin alone, the current focal point of exploration, is more than twice the size of Texas.

The logistics of the oil search a thousand miles in the interior are formidable. The rain forest area is accessible only by river. Oil finders must battle the weather as well as the jungle and vast distances in the Amazonas. Exploration must be accelerated during the few months of the "dry" season, more accurately called the low-water season, which runs only from the last of July through September.

Only a few days a year are suitable for taking photographs, which are essential to building good basin maps. Topographical maps are often inaccurate. Existing maps in some cases have rivers spotted as much as 50 km. from their actual locations. Geophysical crews live on houseboats, and supplies sufficient for 4 to 6 months of operation by field parties must be cached along the rivers.

Head of the program . . . To organize this ambitious undertaking, Brazil has chosen one of the world's best-known oil finders.

Walter K. Link, head of Petrobras, exploration department, has had over 30 years of geological experience, much of it in South America. He was chief geologist for Standard Oil Co. (N. J.) and exploration advisor for International Petroleum Co., Jersey subsidiary.

Brazil's exploration efforts this year might be considered microscopic by some standards, but they are a start and Link is far from discouraged. He has a $10,000,000 budget to operate on.

To keep the program rolling Link has been expanding his technical staff. He has been forced to look abroad as there are very few Brazilian geologists available. On his staff there are Hungarian, Swiss, German, Dutch English, Colombian, Australian, and British West Indies geologists and geophysicists.

Current activity . . . While the oil search is still small in scope, activity is increasing steadily.

In an interview with the Journal in Brazil, Link described how efforts are being stepped up.

"Last year there were six seismograph crews in operation and now there are nine," he said, "with four more projected for the latter part of the year. Gravimeter crews were increased from three to five with another one projected for this year.

"Surface field parties have been increased from 4 to 12. Wildcat rigs in operation outside of the Reconcavo producing area have been increased from four to seven with others preparing to move in."

Initial success . . . Petrobras found oil with its first deep test in the vast Amazon basin. The 1 Nova Olinda, located on the Maderia River, a navigable branch of the Amazon, tested more than 250 bbl. daily of 40°-gravity oil from 8,195-9,059 ft. *(The Oil and Gas Journal, April 11, 1955, page 95).* The fact that a seismic anomaly was drilled in the first test ever made in this vast region raised hopes that Brazil may become one of the great oil producers of the Western Hemisphere.

Link describes the strike as the biggest oil event in this hemisphere since Leduc in Canada, and the Williston basin in the United States.

In attacking his job, Link found the area was so vast that the major problem was where to start.

"We certainly have plenty of virgin territory in which to explore," he observes. "The trouble is we have too much virgin territory."

But Nova Olinda answered the question of where to start.

"It is up in the Amazon that our greatest exploration effort is being made," Link says. "Actually, exploration work is being done on the middle and lower Amazonas area or only on about one-third of the whole Ama-

zon basin. Mostly the work is concentrated in a radius of 125 km., with Nova Olinda as the center. Since the first well of consequence showed oil, we decided that this was as good a place as any to start."

Amazon basin . . . Nine of the 31 wildcats planned this year were slated for the Amazon basin.

One wildcat and a stratigraphic test are now drilling in the general Nova Olinda area. The wildcat is the 1 Vila Abacaxis. Another wildcat is to spud soon.

Four seismic crews, including one water crew, are shooting all the rivers that can be navigated. By the end of the year four more portable land crews will be in the area. The land crews delineate the leads turned up by shooting in the rivers.

Three gravity crews are doing reconnaissance work around Nova Olinda. Other crews will move to the Amazon as work is finished in the Reconcavo (Salvador) area.

Six surface geological field parties are organized to map the Paleozoic outcrop areas on the north and south margins of the Amazon basin. These outcrop bands, 30 to 60 miles wide, stretch from the mouth of the Amazon for some 600 miles. They are the only outcrops that can be mapped by surface geology at this time. Taken together, they are bigger than the State of Texas, and so far there are only three wells to yield geological data.

Sergipe-Alagoas . . . A Brazilian gravity crew and two surface field parties are operating in Sergipe. In Alagoas there are two Brazilian gravity crews and two U. S. seismograph contract crews.

In addition the Brazilian air transport company, Cruzeiro do Sul, is taking aerial photos of the Sergipe-Alagoas coastal sedimentary area. This aerial mapping program is about 95 per cent complete. When the water crew has completed its work in Todos os Santos Bay it will spend 3 to 4 months shooting the Sergipe-Alagoas continental shelf.

A wildcat will be started the fourth quarter of this year.

Rio Grande do Norte . . . The first test in this area was abandoned as a dry hole, and another wildcat will be completed in the Mossoro basin near Macau this year.

Both were located on structure. Their main purpose is to map out the sediments to help guide future exploration

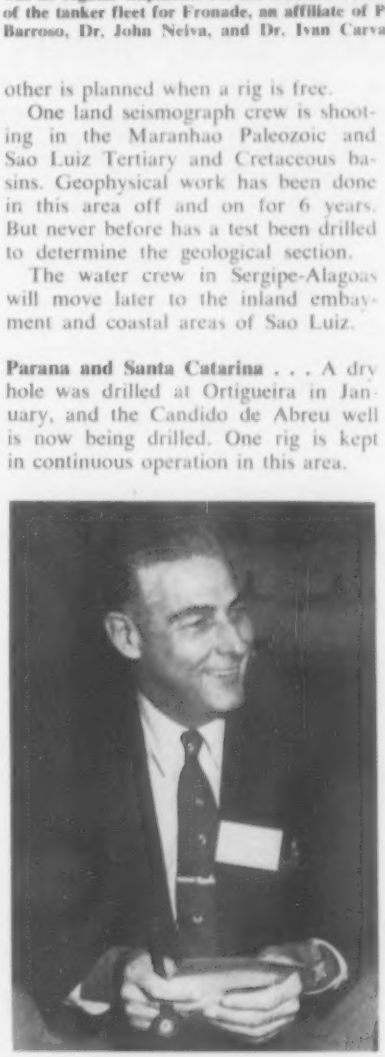
Maranhao-Sao Luiz . . . Two wildcats are being drilled in this area, and another is planned when a rig is free.

One land seismograph crew is shooting in the Maranhao Paleozoic and Sao Luiz Tertiary and Cretaceous basins. Geophysical work has been done in this area off and on for 6 years. But never before has a test been drilled to determine the geological section.

The water crew in Sergipe-Alagoas will move later to the inland embayment and coastal areas of Sao Luiz.

Parana and Santa Catarina . . . A dry hole was drilled at Ortigueira in January, and the Candido de Abreu well is now being drilled. One rig is kept in continuous operation in this area.

THE FIRST TANKER OF BAHIA CRUDE arrived recently at Santos to inaugurate what will be regular shipments for the Cubatao refinery. Dr. Saldanha de Gama, left, superintendent of the tanker fleet for Fronade, an affiliate of Petrobras, was on hand to congratulate Dr. G. C. Barroso, Dr. John Neiva, and Dr. Ivan Carvalho on the arrival of the crude.



WALTER K. LINK
. . . his exploration area is bigger than the U. S.

There are also two surface geology parties at work.

Salvador basin . . . The Salvador (Bahia) fields are the source of Brazil's current oil production.

Two recent developments have spurred increased production from Salvador fields.

The 40-mile, 6-in. pipeline from the Mata-Catu trend to the Mataripe refinery was recently completed, giving the field a new outlet.

The first tanker shipment of Salvador crude also recently arrived at Santos, where it will be processed at the nearby Cubatao refinery. This was the inauguration of what is planned as regular shipments from Salvador fields to Santos.

Both development and wildcat drilling is planned in Salvador. Fourteen tests were planned in 1956.

A water crew has been shooting Todos os Santos in the large Salvador Bay region. In Don Joao field, a 6-km. extension has been made in shallow water into the bay. There are still other Salvador Bay prospects.

A land seismic crew began work in the Salvador-Reconcavo region in June. Shallow core drilling is being done to delineate structure. One geological field party is in the basin and is to be joined by a second.

Production goal . . . Petrobras has set a goal of 20,000 to 25,000 bbl. daily by the end of 1956. This compares with only 6,000 bbl. daily in 1955 and 2,500 in 1954. The goal would appear to be overly optimistic in view of the fact that production had increased only to 7,000 bbl. daily in June.

Pakistan Split Made Unanimous

PAKISTAN PETROLEUM, LTD., last week moved into line with the other four companies operating in Pakistan with an agreement to share future profits from oil production on a 50-50 basis with the government.

The agreement was signed by M. J. Condon, P.P.L. chairman (seated at left), and Abbas Khaleeli, Pakistan secretary of the ministry of industries (seated right). Standing, left to right, are J. C. Finlay, P.P.L. manager; Abdul Latif, deputy secretary of industries; and M. Siddiqui, Pakistan's director of mineral concessions.

Pakistan Petroleum, a Burmah Oil Co., Ltd., subsidiary, has been carrying on an active exploration program in Pakistan and has spent nearly $17 million in the country in the past 6 years. The company has operated under the terms of the 1949 Pakistan Petroleum Production Rules which call for the payment of 12½ per cent royalty to the government.

When Standard Vacuum Oil Co., Hunt International Oil Co., and the Royal Dutch-Shell group entered the Pakistan exploration picture within the past 2 years, each did so on a 50-50 profit-sharing basis with the government. The same thing is true of Pakistan Oilfields, Ltd., a subsidiary of Attock Oil Co., Ltd.

Attock and P.P.L. have the country's only production, about 5,700 bbl. daily from Khaur, Dhulian, Joya Mair, and Balkassar fields in the northern portion of West Punjab in West Pakistan.

Terms of deal . . . The new agreement also provides that all foreign exchange for Pakistan Petroleum's exploration activities will be provided by nonresident shareholders of the company. This is designed to benefit the government and Pakistani nationals who together own a 30 per cent interest in the company.

If Pakistan Petroleum discovers oil in commercial quantities, it is obligated under the new agreement to locate, build, and operate a refinery to supply Pakistan's domestic oil requirements.

New Blow Threatens Wildcat

A directional well will be drilled by American experts in an effort to solve blowout troubles of the National Iranian Oil Co.'s sensational wildcat near Qum, 50 miles south of Teheran.

Eastman International Co. of Denver already has sent engineers to Iran for the job. The technical group is headed by L. P. Gates, senior field engineer for Eastman Oil Well Survey Co. of Houston, parent firm of the international company.

Gates will be assisted by directional drilling experts attached to Eastman International's Hanover, Germany, office and other engineers now in the Middle East.

The 5 Alborz blew in wild more than a month ago, flowing more than 80,000 bbl. of crude a day over 200 ft. into the air. It was capped 3 weeks ago by Myron Kinley, Houston oil well firefighter, and engineers from N.I.O.C. and consortium companies. However, Iranian National last week reported the cap was leaking, and the well again threatened to blow wild.

International BRIEFS

Prospects for finding commercial production in Peru's Sechura Desert continue to grow dimmer.

The dozen companies which had more than 4,100,000 acres under concession in the area have returned nearly 2,700,000 acres to the government. Exploration work in the once highly regarded region has cost around $22,000,000. Twenty-two wells have been drilled with poor results.

Some drilling is continuing on the remaining acreage. But most exploration activity is now concentrated in eastern Peru.

A Royal Dutch-Shell company will build a $4,900,000 styrene-monomer plant along the Manchester ship channel in Northwest England as part of the group's expanding petrochemical activities. Petrochemicals, Ltd., the associated company, expects to begin production in 1958.

India's top oil official, K. D. Malavrya, last week wound up a tour of U.S. and Canadian oil fields and plants. The minister of natural resources and scientific research has been studying Western techniques after a similar visit to Russia. He concluded his U.S. visit with conferences with State and Interior officials.

The Indian Government is sending its young technicians to Russia for training and is using Russian equipment in its search for oil. An American company is now conducting exploration activities in India. The development has been billed as a test of Russian and American techniques.

Hungary's most important oil field is having water encroachment trouble because of overproduction, according to the country's Communist Party newspaper. The field, at Nagylengyel, had been one of the major accomplishments of the last 5-year plan.

Oil discoveries in several areas of the Uzbek Soviet Socialist Republic in Central Asia have boosted production by the Central Asia Oil Combine to goals originally set for early 1957, according to Russian news reports.

Four new pools were reported in the Fergana Valley of eastern Uzbekistan. The latest well, completed at a depth of 8,070 ft., flowed 120 metric tons of oil in 24 hours.

Another discovery was announced early in September at Lial-Mikar in the Surkhan-Darinsky district of southern Uzbekistan. It is the second successful completion in the area.

HOW TO GET YOUR MONEY'S WORTH FROM YOUR

Drill String

• DRILL PIPE • DRILL COLLARS • TOOL JOINTS

Cost of operating the drill string is one expense we can largely control. In the following pages is a guide to help you in buying, using, and caring for your drill string. Use this information and you'll be a long way toward controlling operating cost.

BY ED McGHEE, JOURNAL DISTRICT EDITOR

THAT'S no ordinary drill collar Joe has there. It's special — it has drilled more feet of hole than any other collar ever used on Joe's rig. Not only did this collar save a lot of money, but it has helped give Joe and his crew a reputation as some of the best drilling men in their area.

From the very first, this has been a special collar. It is the best-suited collar available for the kind of drilling Joe's rig is doing. Joe took into consideration the well depth, hole size, weight on bit, likeliness of corrosion, and abrasiveness of the formations; and he bought this collar because it was the best for those conditions.

This collar got special treatment, too. Joe and his crew thought about all the things that could turn the collar and the rest of the string into junk. And they were careful that none of those things happened.

Therefore, the collar and the rest of the string lasted a long time and did a good job. As a result, Joe and his crew are known as careful operators who know how to keep expenses down.

Joe told us how he picked the special collar and the rest of his special string and how he kept it running trouble free. Here, in this section, we're passing it on to you.

It's a full-time job . . . The big thing to remember about caring for a drill string is that you can never let up—not for a single well, a single day, nor a single tour. A careless crew that runs the string just once without tonging it tightly enough could start an epidemic of trouble that would be a plague the rest of the string's life.

A box shoulder not dressed off immediately after a slight damage will probably wind up being hauled to the shop for reworking. Even worse, it might become the start of a long, expensive fishing job.

Here's a quick summary of some of the things to look out for:

. . . Drill collars. Get them big enough with large enough bore. Inspect them regularly and make them up tight. Use plenty of good thread dope and don't turn rotary too fast.

. . . Tool joints. Break them in right and always make them up tight. Don't run a bad joint back into the ground and don't continue to use a bad kelly-saver sub. Be careful when moving, pulling up, or tripping so that threads and shoulders are not bumped. Dress off slight damage with hand tools and use plenty of good thread dope.

. . . Drill pipe. Keep it straight and in tension. Don't let it turn in the table slips and don't set the slips while the pipe is still moving downward too fast.

To get all the details, turn the page.

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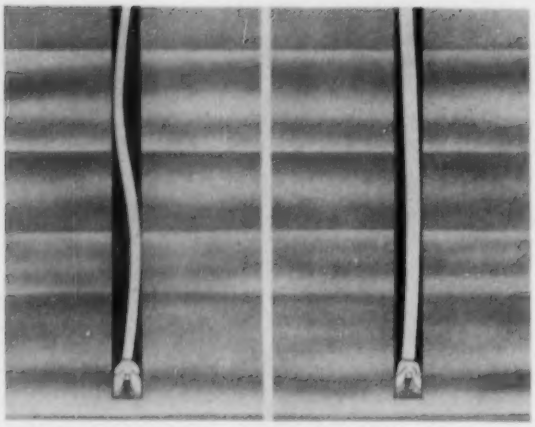
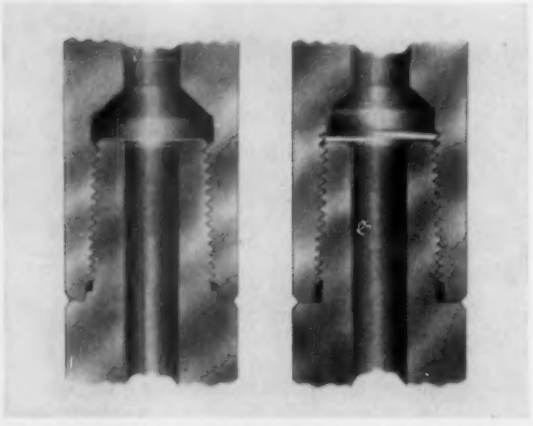
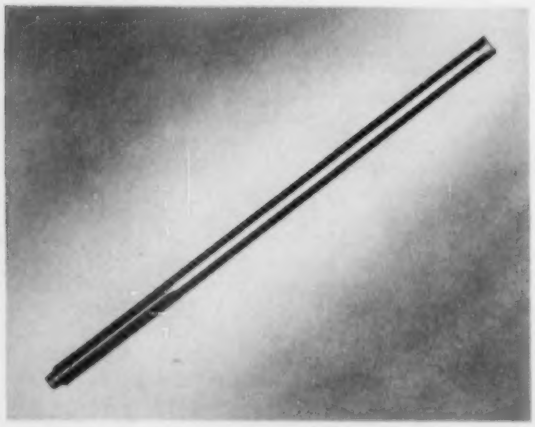


GET BIGGEST COLLARS PRACTICAL for hole you'll be drilling. Small drill collars buckle, put big strain on connections, and cause bit to "walk" around bottom of hole. Bigger collars pay off in longer bit life, straighter hole, and fewer connection failures. Fig. 1.



USE STRESS-RELIEF GROOVES. Left: machined at bottom of box, groove removes unengaged threads and reduces stress concentration. Right: a stress-relief groove at base of pin. Fig. 2.



BIG BORE, LOW PRESSURE DROP. Little of a collar's weight and stiffness is lost in increasing bore size from 2¼ in. to 2¾ in., but there will be less pressure loss through the larger bore. Here, by step boring, the collar gets larger bore over much of its length but keeps good pin strength. Fig. 3.

When you BUY drill collars . . .

Get them big enough . . . The biggest-diameter drill collar you can safely operate in a given hole size will be the most economical in the long run. Because the larger collars cannot bend or buckle so much in the hole, joint failures will be fewer.

See Fig. 1

Field experience with bigger collars shows drilling rates are faster for a given indicator weight and bit life is longer, less weight is lost through the collar's buckling against the side of the hole, and there is less "walking" of the bit around the bottom of the hole. The result is uniform weight on bit that makes hole faster and evens bit wear.

Of course, during drilling with large collars, there are fewer sharp turns and dog legs in the hole. Because of this fact, wear is less on the drill pipe and tool joints. Besides, bigger collars mean you can use fewer collars to get the same weight on bit.

Overshots and wash pipe for many "oversize" drill collars are becoming available, and taper taps generally do a good job otherwise. Experience proves that using large collars is not as risky as it seemed in the past.

Make sure connection design is good . . . Bad operating practices such as improper makeup still cause many washouts, leaky joints, and galled threads. Still, most drill-collar failures are a result of fatigue at the joint. And, good connection design can cut down the number of these fatigue failures.

First, the connection should be balanced for good strength in both pin and box. In areas where wear is fast, pins may be smaller to keep a reasonable box strength as the collar wears down.

Stress-relief contours are important, too. Stress-relief grooves in both pin and box remove threads that are not normally engaged. Although this reduces the cross-section area of the connection, connection strength in fatigue is higher because there is less stress concentration when sharp thread-root notches are removed. In areas where corrosion attacks the unengaged threads, the relief grooves cut down corrosion fatigue since the points of corrosion concentration are removed.

See Fig. 2

Think about diameter reductions . . . Some contractors like to use collars with slip grooves or elevator recesses. There are disadvantages to these reductions of the outside diameter—particularly when collars are used in long strings. Anywhere there is a reduction in the diameter of the collar, there is stress concentration. The greater the diameter reduction and the sharper the change, the greater will be the resulting stress concentration.

As collars become shorter due to rethreading, elevator recesses and slip grooves will become stress raisers for the box section. The result can be early failure of the connection.

Of course, using outside-flush collars does away with the problem. However, if some form of diameter reduction is used, it should be carefully engineered and treated to prevent overstress.

Use pin-by-box collars where practical . . . The more threaded connections in a drill-collar string, the more places there are for failure. Of course, doubling the number of threaded connections won't halve the life of a collar—every threaded connection in the string

should last just as long as any other. But when trouble does come, it's easier to spot and fix on a string with few threaded connections. For that reason, collars should be pin by box where it is practical.

If the string is to be used in remote locations, transporting collars back to the shop for rethreading may be difficult or impossible. Then, replaceable collar ends or double-pin subs may make a saving in transportation and in valuable collar length. But in normal drilling service these should not be used.

Long field experience shows that joints with the pins looking up can give as good service as joints with pins looking down if they are properly made up. Many operators are now running pinup strings successfully. A fishing neck on the pin end does not lower the joint strength appreciably, and in string-shot jobs, such a pin end does not catch junk as a box does.

Make sure bore is big enough . . . With long collar strings, much of the pressure put up by a rig's mud pumps is lost through the drill collars. And this pressure drop will be even higher through long strings of small-bore collars. Very little of a big collar's weight and stiffness are lost by increasing the bore from 2¼ in. to 2¾ in.; but on a string of 20 such collars, the larger bore could mean as much as 25 per cent saving in total pump power.

See Fig. 3

About 1.8 times as much power is lost pumping through 2-in. bore collars as through 2¼-in. bore collars. About three times as much power is lost pumping through 2¼-in. collars as through 2¾-in. collars. Further, collar bore has to be large to pass wire-line coring tools.

One popular way to get the best hydraulic properties and still keep good pin strength is to "step bore" the collar. For example, you might use a 2½ or 2¾-in. bore for 25 ft. from the box end and use 2 or 2¼-in. bore for 5 ft. from the pin end.

Why drill collars FAIL . . .

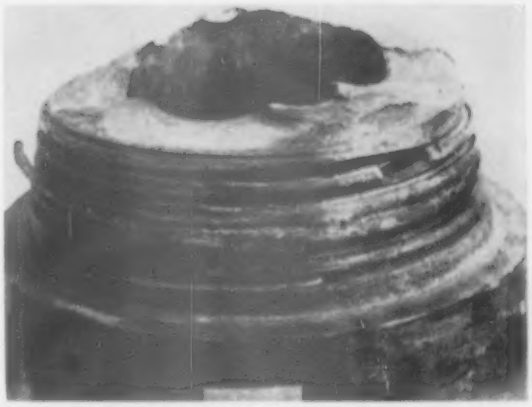
Too high rotary speed . . . Turning the rotary too fast is one of the biggest causes of collar failure. Even new collars properly made up can be made to fail by fatigue in a relatively short time if rotating speed is too high. There seems to be a very fine line between safe speeds and too-high speeds. Some believe that the collar string has a critical speed above which vibrations set up and put extremely high stresses on the collar joints. There is, however, no way to calculate this critical speed. Experience in each area of operation is still the best, surest way to keep rotary r.p.m. in line.

See Fig. 4

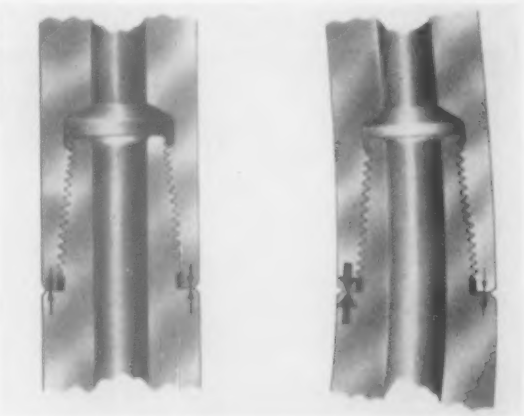
Too-loose makeup . . . Remember that the drill-collar connection has two parts—the threads and the shoulders—and they act together. The threads cannot seal; only the shoulders can seal. If the shoulders aren't made up tightly enough to seal, it means that the threads aren't tight enough either. And the joint will wobble.

See Fig. 5

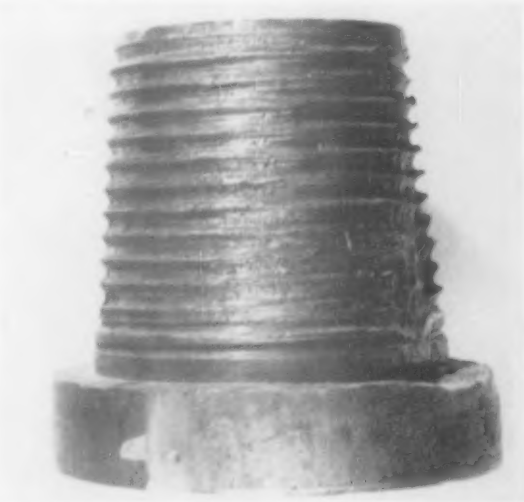
When a joint wobbles, there are great alternating stresses repeatedly put on the threads; these stresses bring on fatigue failure in a hurry. This same wobbling action causes lapping and wearing of both threads and shoulders, causing broken or galled threads. Although



TOO FAST ROTARY SPEED results in quick fatigue failures like this one. Even new collars properly made up can be made to fail early from high loads caused by turning rotary too fast. Fig. 4.



MAKEUP MUST BE TIGHT. A collar connection properly made up has its shoulders tightly compressed as at left. Same collar in hole during drilling can bend enough to reduce compression between shoulders as at right. If connection isn't made up tightly enough, bending load will be thrown onto threads. Fig. 5.



GALLING AND THREAD BREAKAGE such as this result from a leaking pin shoulder. The trouble might have started from poor makeup, too fast rotary speed, or careless handling. Fig. 6.

USE A TORQUE INDICATOR of some kind—it's the only practical way to control collar makeup. On big collars (7-in. and larger) a snatch-block system such as this should be used to get tight makeup. Fig. 7.

INSPECTION PAYS OFF by showing cracks in connection before cracks become failures. This Magnaglo inspection makes use of fact that magnetic particles immersed in kerosine glow under an ultraviolet light. Note coil to magnetize joint. Fig. 8.

MOST IMPORTANT INSPECTION. Use of an inspection service does not relieve crew of its duty to make a visual inspection of collar connections on each trip. They should watch for lapped shoulders, sharp threads, and dry connections. Fig. 9.

a joint may not fail immediately if it is run too loose once, it will likely not seal if run again. And, it will fail completely much sooner than it should.

Too-tight makeup . . . Making up connections too tightly can also cause damage, especially in the smaller-size collars. The tool joint or collar connection is an efficient screw jack. And when made up, this jack is trying to pull off the pin at the shoulder and trying to "squash out" the box at the shoulder. If made up too tightly, the result is stretched or broken pins, and, occasionally, swelled boxes with conical-shaped shoulders.

Running small collars in big hole . . . Running little collars in a big hole is like turning at high speed a long, limber shaft without bearing supports. Little collars buckle under load and bring on high stresses in the joints. The bigger the hole, the greater the bend and the higher the stresses. These high loads and critical stresses will bring early fatigue failure even in properly made up collars.

Running crooked collars . . . Crooked collars have about the same effect as too-small collars in a big hole. The crooked collar makes the joints flex abnormally bringing on early fatigue failure of the connection.

Poor lubrication . . . Dirty, poorly lubricated drill-collar connections are very apt to gall since they will not make up as tightly as they should for their proper make-up torque. Fortunately, most drillers now make certain that their crews keep the joints clean and well "doped" with the proper dope.

Poor handling at surface . . . There are many ways to damage drill-collar connections when they are out of the ground, such as in moving, laying down, hoisting through the V-door, and stabbing. Most of this damage is the result of carelessness or not using a good thread protector.

See Fig. 6

Shoulder wobble . . . A lot of drill-collar failures are blamed on "shoulder wobble"; but, actually, the wobble is just what happens as a result of some of the above bad practices. For some reason, the shoulder is not sealing as it should and the joint wobbles—and then fails. The wobble may be due to mating a good pin or box with another which has previously wobbled in the hole. Wobbling may be the immediate cause of failure, but it is, itself, a result of bad practice—not necessarily a result of a poorly made collar.

Corrosion fatigue . . . In West Texas and some other areas, corrosion fatigue is a frequent cause of drill-collar failure. This is true although the collars are cared for as they should be. Corrosion will attack the unengaged threads at the bottom of the box and lead to cracks and eventual failure.

Poor connection design . . . Most manufacturers of drill collars use some sort of stress-relief grooving in the connection of their collars. Also, most machine shops do this when the joint is rethreaded. However, some do not; and some are careless about rounding the thread roots. Sharp V-cut threads are natural stress raisers that will be a source of trouble.

All connections should have the same bevel on the outside dimensions. If one has more bevel than the

other, the smaller will wear into the larger and cause a groove around that shoulder.

Wear on outside diameter . . . In use, all collars wear down gradually on the outside diameter. In some places, the formations are more abrasive and collars wear faster. If the collar is in service too long, the boxes become thin and will fail. The problem is worse when the joint is of such a design that the box section is already thin.

How to make drill collars LAST LONGER

Control makeup . . . The only practical way to make up collars is to follow exactly the manufacturer's recommended torque for that size connection. This can be done only by periodically checking the torque as the connection is made up. There are several different torque indicators on the market that will show if the cathead is pulling as hard as it should. If it isn't, the driller can change his setup until the torque indicator shows the right torque.

A smooth, steady pull with a rope is the best way to make up drill-collar connections. Makeup with a jerk action on the tongs will not get the connection as tight as will a steady pull. On big collars (7-in. and larger) a snatch-block system may be needed to get tight makeup.

See Fig. 7

Don't let rotary speed get too high . . . Keeping rotary speed in line is easy to say but not so easy to do. Few rigs have equipment to show rotary r.p.m. accurately. Specifying the gear in which the rotary is to be run will narrow its speed down to within 10 or 20 r.p.m.; keeping the driller from speeding it up is a matter of discipline.

Use large enough collars . . . Use the largest-diameter collar that is safe in the hole size being drilled. The higher the weight on bit, the greater the need for big collars. This applies even on surface hole, which is relatively shallow.

Inspect them regularly . . . One fishing job will cost more than several drill-collar-connection inspections. Magnetic particle inspection will show fatigue cracks so that the connection can be rethreaded before it fails completely. Usually, it is cheapest to have the collars inspected at the rig. This can be done at the rotary table during a trip; but it can be better done while the collars are on the rack at the end of a well.

See Fig. 8

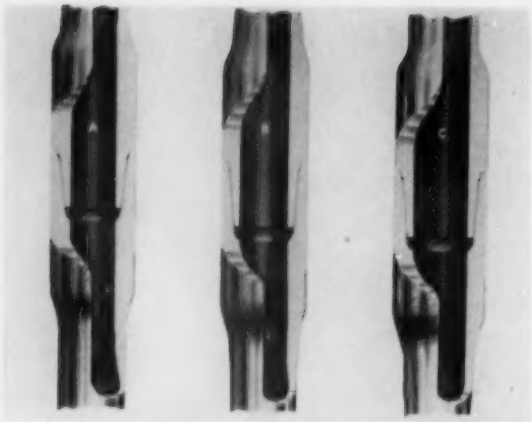
With periodic inspection only damaged or cracked joints are rethreaded; the good ones go on serving until a later inspection shows they need work. The alternative is to let the entire string go until there are enough failures to prove that **all** joints should be reworked. Periodic inspection usually costs more in trucking expense but it will pay out by stopping many fishing jobs. Machine-shop bills will also be lower as only those connections are shopped that are actually damaged—not the entire string.

Using an inspection service does not relieve the

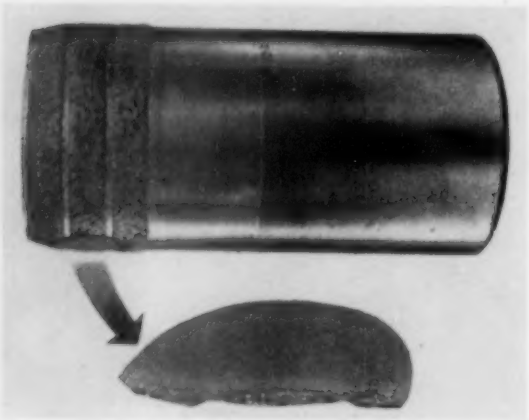
STEP IN TIME SAVES NINE. Crew should use a shoulder-facing tool at first sign of a leaking joint. If this repair is made in time, it will likely save the expense of recutting the joint in a machine shop. Fig. 10.

COLD ROLLING THREAD ROOTS on a drill-collar connection lengthens its life by putting surface layer of metal in compression. This makes roots less likely to crack due to fatigue. Fig. 11.

STUBBING REGAINS LENGTH. If weld is properly made, stub-ended collars will give long, troublefree service. Both pressure-weld and electric-arc methods have proved reliable. This is specialized work and should be done in a properly equipped shop. Fig. 12.



FULL-HOLE, EXTRA-HOLE, FLUSH. Here are the most popular styles of tool joints: "A," A.P.I. full-hole; "B," extra-hole; and "C," A.P.I. internal-flush. Note the differences on the upsets of the pipe. Note also the hardface material; it is optional. Fig. 13.



HARDFACE JOINTS BEFORE USE. Best time to put hardfacing material on a tool joint is in the manufacturer's shop before joint is used. Here three bands of the wear-resistant material have been bonded onto the joint. Fig. 14.

QUICK CHANGE AT RIG. If joints ever have to be removed from the drill pipe while drilling in remote areas, cheapest joint will likely be shrink-fit type. As shown, joints can be applied or removed in field, saving transportation costs. Fig. 15.

crew of its duty to make a visual inspection of the collar joints on each trip. The crew should watch for galls, lapped shoulders, cracked threads, and dry (or muddy) connections.

See Fig. 9

Keep joints clean and well lubricated . . . Connections should be kept clean and be well doped before being made up. Thread dope for drill-collar connections should have the maximum resistance to galling and, at the same time, minimize frictions. This assures highest shoulder compression and thread protection. Best lubricants for collars have at least 50 per cent by weight of finely powdered metallic zinc or other equivalent material.

Protect against corrosion . . . In most areas, corrosion is little or no problem. In areas where it is bad, there are several things that help to protect against it. One of the most widely used is an inhibitor added to the mud. Just as important is taking care that the mud is not contaminated unnecessarily by salt.

Magnesium-anode rings can be used in the bottom of the box to prevent corrosion of the threads; this is helpful in severely corrosive areas. The clear-water emulsion drilling fluid newly introduced seems to help also.

If corrosion is bad, it is even more important to inspect collars regularly. Even though corrosion makes proper inspection more difficult, cracks can be found in time to prevent a costly failure in the hole.

Handle collars carefully . . . The first thing to remember is that collar connections are precision machines and have to be treated that way if they are to last a long time. Collars should be backed out and spun up with chain tongs to avoid burning threads. This is especially important with new connection for the first five or six makeups.

Coat the threads with a rust preventive when they are out of service for any length of time, however short. Don't let the pins bang into the box shoulders during stabbing. Don't let the elevators or hook hit the box shoulder. The tongs can ruin the shoulder seal if they grip the collar too close to the connection.

Use thread protectors during moves. Also, when hauling collars, support them at points about 4 ft. from each end and again at the middle. Otherwise, the collars are apt to be crooked.

Dress off slight shoulder damage . . . If the shoulder of the connection is only slightly damaged, it can be dressed off with hand tools. This should be done immediately to keep the damage from getting worse. If the damage is too severe, the collar should be sent to the shop for repair.

See Fig. 10

Make sure rethreading is done right . . . In machining drill-collar connections, these things are important: (1) taper; (2) thread form; (3) lead; (4) square shoulders; (5) good fit with ring and plug gage; and (6) good surface finish. A joint made with a thread mill using a hob will help insure that these things are correct. However, a good joint can be cut on a lathe under close supervision. Any reputable manufacturer of drill collars will be glad to check the machine work for you.

See Fig. 11

Cold rolling of threads at machine shops will greatly increase fatigue strength of the connection by putting the surface layer of metal in the thread roots in compression. Thus, the cracks are less likely to open up in fatigue.

Stub-end short collars . . . There is no technical reason why short drill collars cannot be kept in use by stubbing new ends onto them. The science of welding has advanced enough that a properly made weld should not fail any sooner than the body of the collar. Both pressure welding and arc welding have proved to give a strong, reliable job if done well.

See Fig. 12

After the stub is added, the welded surface should be machined smooth, inside and out, to remove any notches or stress raisers that could result from the weld. Then the welded area must be stress relieved by a high-temperature draw or normalizing heat treatment.

This is specialized work and should be done by a reliable shop properly equipped to do the job.

Hardface the ends . . . There is no point in stubbing on ends of greater diameter than the collar itself unless the new end is protected by hardfacing. Otherwise, the end will soon be worn back to the same diameter as the collar itself. Hardfacing may also be put on drill collars with a straight outside surface in order to cut down the rate of wear. Usually, the hardfacing material is put on a 10 or 20-in. wide band some 20 to 30 in. from the pin shoulder. This protects the joint area from outside wear, thus increasing its life expectancy.

Keep them straight . . . Straight collars not only wear down slower, but they also are safer from troubles at the connections. Except for service in the hole, most crooked collars are a result of abuse during storage or moving. Support the collars in several places along their length so that they don't hang with a bow in the middle.

When you BUY tool joints . . .

Where are you going to drill? . . . The type of drilling and the area of use are the biggest single questions that decide which tool joint is cheapest and best. Type of drilling dictates which kind and size of drill pipe will be needed. And the pipe dictates which style of tool joint will go on it. The type of drilling will dictate whether the joint will ever have to be removed from the pipe. And removal of tool joints dictates how the joint must be connected to the pipe.

The area of drilling dictates the cost of transportation. And cost of transportation can make one joint cheaper than another.

Below, the things about type of drilling which affect purchase of tool joints, are broken into parts.

Do you need FH, IF, EH, or SH joints? . . . Choice in style of tool joints depends on the drilling for which they are to be used. A.P.I. "Regular" joints were the first standard joint developed and have a relatively small outside and inside diameter. Because of these small diameters, regular tool joints cause a great pressure drop of mud stream through their bore; moreover, they are too small to pass many wire-line tools. As a result, Regular tool joints are used only rarely today. In most cases where pressure loss is not important and where the clearance between joint and hole walls must be the greatest, most operators prefer slim-hole or double-streamline joints.

Next joint developed after the Regular joint was the "Full-Hole" joint. It has about the same internal bore as the internal upset on the pipe itself. Thus, it will cut down on pressure drop in the mud stream and it will pass almost any tool that the pipe itself will pass. Many full-hole joints are used today.

See Fig. 13

As wells became deeper and pressure on the mud pumps went higher, it became important to get a tool joint that had even less restrictions through its bore. For that reason, the A.P.I. next adopted the internal-flush joint to be used on internal-upset pipe. With this combination, there is no more pressure loss through the upset section of the pipe and joint than there is through the body of the pipe. And the joint will pass any tool that will pass through the body of the pipe.

Most manufacturers now make a modified joint, generally known as the extra-hole joint. This joint is used on internally upset pipe but has a greater bore diameter than does the standard full-hole joint. At same time, it is not as large on the outside diameter as the internal-flush joint. This extra-hole joint has become very popular because it has advantages of both the other types of joints but does not have some of their disadvantages.

If the drill string is to be used in service that puts extremely high torque on it (such as in certain types of fishing, running reversing tools, and underreaming), the larger-diameter tool joints should be used. The internal-flush, and extra-hole joints have higher torsional strength than the smaller-diameter full-hole and slim-hole joints.

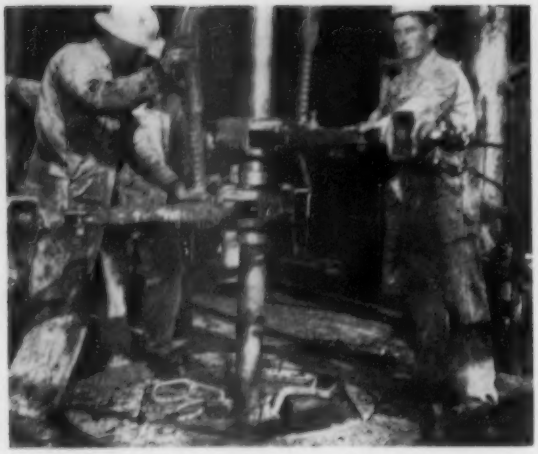
If the string is to be used in areas where tool joints wear fast, the smaller-diameter tool joints can be the cheapest. While they do cause more pressure drop in the mud stream, full-hole and extra-hole joints last longer than the internal-flush. If internal-flush joints are to be used in quick-wear areas, they should be hard-banded beforehand. Extra-hole joints are slightly larger in diameter than full-hole joints, and they also have a thicker section to retain strength through longer use.

Have them hard faced by the manufacturer if wear is to be bad . . . The most effective hardfacing job on tool joints can be done by the manufacturer before they are put on the pipe. Most manufacturers heat treat the joints and finish machining the threads after hardfacing. And the joints will give a lot of service before this initial hardface is gone and the tool joints themselves are being worn. This original hardfacing is better and safer than letting the tool joint wear thin in the field and then putting on the hardface material.

See Fig. 14

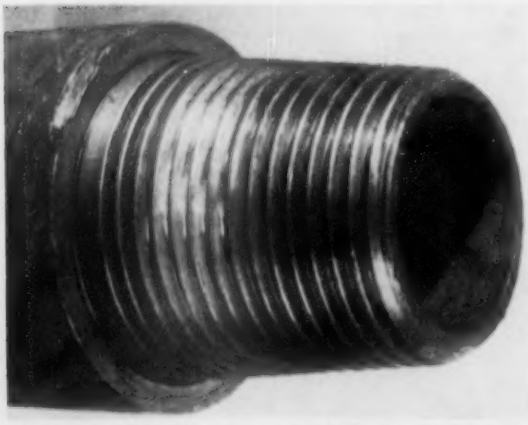
Will you ever have to remove tool joints? . . . In areas where tool joints wear quicker than does the drill pipe, hardfacing the joint will help even out the wear. Many times, this technique can make the tool joint last just as long as the pipe itself—even if it's necessary to rehardface the joint in the field. If so, pipe and pipe joints are worn out at the same time and thrown away together.

But there are times when it will be necessary to remove the tool joint from the pipe on which it is



DERRICK FLOOR IS ONLY PLACE where tool joints can be made up—they will not make up any further in the hole drilling. Each joint must be made up tight every trip because running loose one time can cause wobbling. Fig. 16.

LACK OF ENOUGH "DOPE" caused this thread gall. Tool joints should always be doped properly, especially important on new joints which have not yet become work hardened. Fig. 17.



CARELESS TONGING was cause of damage to tool joint. Tongs should never grip close to shoulders. However, many such cases of damage can be repaired by hand tools. If done immediately, further trouble will be prevented. Fig. 18.

originally put. In some areas, the pipe wears quicker than the joint, and the joints can be reclaimed for use on another string. In some areas, the formations are so abrasive that hardfacing will not lengthen the life of the joint to that of the pipe. Then, in these cases, it is very important to get a pipe-to-joint connection that will let the joint be removed cheaply.

Unitized joints almost completely eliminate the failures of the connection between them and the drill pipe. For that reason, welded-on joints in many areas turn out to be the cheapest in the long run. Moreover, it's easier and safer to hardface the welded-on joints than it is to hardface the screw-on joints. The weld type are thicker and have no threads underneath to be damaged by heat from the hardfacing operations.

Also, it is possible to cut off old welded-on joints and weld on new ones. This can be done by the flash-weld or pressure-weld process. However, there are only a few machines which can do this. For that reason, transporting pipe to these machines can be expensive for remotely located rigs.

When the joints must be changed and welded-on joints are not possible, the best and cheapest solution is shrunk-on joints. These can be hand applied at the rig, and hand removed when worn out. Thus, there is no cost in transporting the pipe to have joints applied or removed.

Shrunk-on joints have a good record for few failures of the pipe-to-joint connection. The same is true of counterbore welded joints when properly applied.

See Fig. 15

How far will pipe and joints have to be shipped? . . . In most drilling areas, shipping costs do not make enough difference to greatly affect the choice of pipe-to-joint connection. Pipe which is shipped to the place where tool joints are welded on and then shipped to the rig can often be cheaper in original cost than other types of strings. However, in some remote locations, this cost of shipping pipe first to welding machine and then to rig can be high enough to make shrunk-on tool joints cheaper. With these, the pipe can be shipped directly from the mill to the rig.

Why tool joints FAIL . . .

Poor makeup. . . Just as with drill-collar connections, one of the biggest causes of tool-joint failure is poor makeup. In modern rotary drilling, there is very little torque in the drill string as it rotates in the hole. In other words, there is little force in drilling that tends to make up the joints; all makeup has to be done when the string is run into the hole.

A loose joint will "wobble" or the mating shoulders of the box and pin will open and close. This wobbling will lap the threads and shoulders of both pins and boxes. The ultimate result is a failure and a fishing job.

See Fig. 16

With today's larger, more powerful automatic catheads, it is also possible to overtong a tool joint. Where the cathead is not periodically checked with a torque indicator of some kind, this is often a cause of failure. When overtonged, the boxes swell and the pins stretch or break.

New tool joints should be made up with the same torque as old ones, but new joints do resist makeup.

For that reason, the new joints need more thread lubricant in order to make up tightly enough at the proper torque. If not doped and tonged properly, the new joints wobble and fail.

Running bad joints back into ground . . . When a joint that has leaked is run back into the hole, it will cause the pin or box mating it to leak also. And wobbling follows leakage. In this way, leaking and wobbling can spread throughout an entire string of pipe. Soon, there will be many of the joints with "sharp" threads, broken threads, and galls on threads and shoulders. One of the signs to look for are joints that are dry when broken out; this means they are not sealing and that mud is washing out the thread dope. When this happens, some drillers will change the dry pin to a good box and the dry box to a good pin, thinking this will stop the trouble. But this procedure only makes two bad joints where there was only one before.

Carelessness in breaking in new tool joints . . . Freshly machined threads on new tool joints are more apt to gall than the work-hardened threads on used tool joints. Moreover, new tool joints need more lubricant to make them up. If the rig crew does not realize this, they are apt not to put enough dope onto the new threads when they are run. Of course, there's always the danger that they may not be tonging the joints tightly enough.

See Fig. 17

Since new threads do not have enough clearance to squeeze foreign matter into, they are more subject to damage by not being cleaned properly.

Since they aren't work hardened, the new threads are more likely than old threads to gall when spun up too fast with a spinning line.

Poor lubrication . . . Old thread dope that has hardened and dried in the connections prevents good makeup. Sand, dirt, and the like on the threads (or in fresh thread compound) do the same. These have the same effect as not tonging a good joint tightly enough—improper makeup which brings on leaking, wobbling, and galling. Moreover, lack of lubricant can cause the threads to gall even if the joint doesn't wobble.

Damage to threads and shoulders in handling . . . It is an easy matter in running a string of pipe to bump the box shoulders with the tool-joint pins. If the blow is hard enough, the box shoulder will be damaged, possibly to the point where it can no longer seal. Likewise, shoulders banged by elevators or hooks can be damaged. Such a damaged shoulder will leak, wobble, and gall. It can lead to complete failure.

See Figs. 18, 19, 20

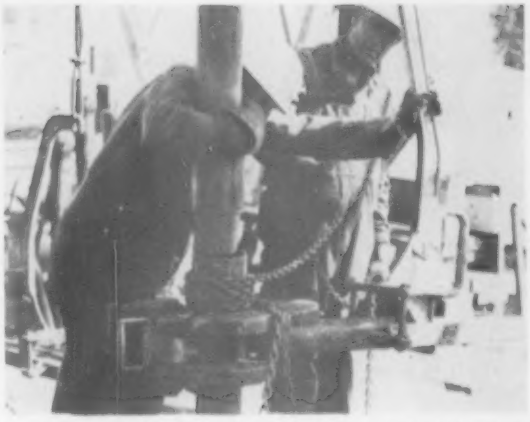
The same damage can come from using a wrench on the pin shoulders to "jack" drill-pipe stands on the derrick floor.

See Figs. 21, 22

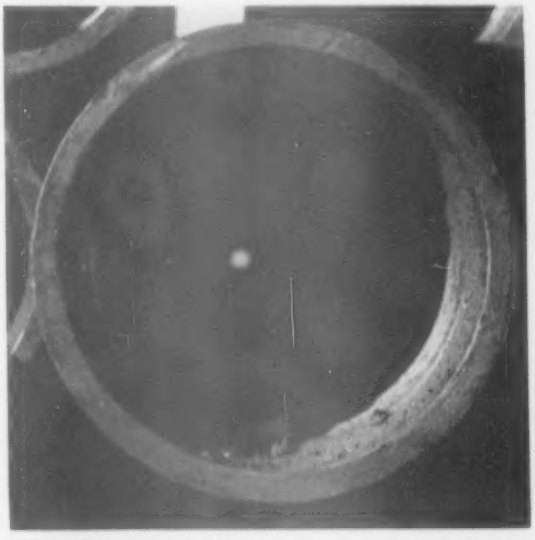
If thread protectors are not used, the thread and shoulders can easily be damaged in moving, hoisting, or laying down pipe.

See Figs. 23, 24

Wear on outside diameter . . . How fast a tool joint wears depends mostly on how abrasive the formations are. However, there are certain conditions that can make wear quicker. Running pipe in compression will

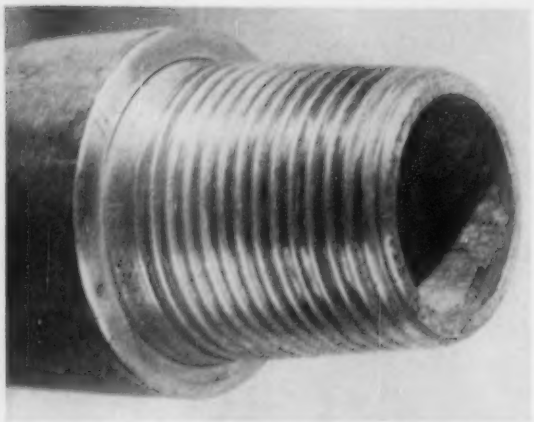


BUMPING OF BOX SHOULDERS by end of pin during stabbing is a common cause of damage. Careful handling will prevent most bumping; a good hook spring will help too. Fig. 19.



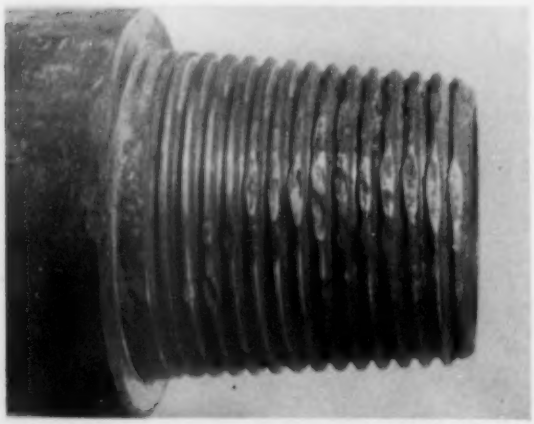
RESULT OF BUMPING with pin shows on this box shoulder. The seal has been destroyed. And if joint is run again, it will leak and cause a washout. Fig. 20.

DON'T USE A WRENCH in this manner to jack pin shoulders. It will cause damage like that in Fig. 22. There are cheap pipe lifters that will move drill-pipe stands just as easily and without damaging pin shoulders. Fig. 21.



DAMAGE FROM WRENCH. This pin shoulder was damaged by being jacked with a wrench like that in Fig. 21. If this damage is not repaired quickly with hand tools, it will start to leak and bring on more serious troubles. Fig. 22.

CARELESS HANDLING is a common source of tool-joint troubles. When picking up joints of pipe like these, a thread protector should be used. Even a wood walk will pack splinters into the threads; striking the steel work will flatten threads. Fig. 23.



ONLY REMEDY NOW is a trip to the machine shop for the threads damaged by handling like that in Fig. 23. Upsets on shoulders can be repaired with hand tools, but not such abused threads. Fig. 24.

cause the tool joints to be forced into the side of the hole, grinding them down faster than they would be otherwise.

In soft formations, wear is generally of the "barrel" type, with the ends of the joint rounded. In harder formations, the wear is usually uniform over the entire length of the joint to produce a "cylindrical" type wear.

If the joints are in service too long, of course, the box section of the tool joint will become thin and fail by swelling.

Wobbling . . . Just as with drill-collar joints, wobbling in tool joints is a result or symptom of some bad operating or handling practice. Wobbling is the final result of loose makeup, poor lubrication, galls on threads or shoulders, or threads and shoulders damaged in handling. When wobbling spreads through the entire string, the reason is probably mating a good joint end with a joint end that has already leaked.

Galling . . . Galling, like wobbling, is usually a result of bad practice. It can be due to loose makeup, poor lubrication, or poor breaking in. If a galled joint is not taken out of the string, it can bring on more serious trouble.

Mating worn-down pin or box with good one . . . All tool joints in use are continually hammered against the sides of the hole. When the pin and box have different outside diameters, this beating could cause the larger one to develop a fin on the shoulder. Ordinarily, the standard bevel on the face diameter prevents such a fin from developing. When the joint is worn down so the bevel is gone, the shoulder can develop such a fin. If the fin is not removed by a file or shoulder-dressing tool, the shoulder can cause galling or leaking on the joint end with which it mates.

Running crooked drill pipe . . . One of the biggest causes of failure in the body of drill pipe is crookedness. Not only does crooked drill pipe wear itself quickly, it also wears and strains the tool joints. The crooked pipe will cause the joint to wear unevenly, or lopsided, shortening its life greatly. Moreover, a crooked joint will whip when it's rotated in the hole. This whipping action can become bad enough to cause early fatigue failure in even a perfect, well-madeup joint.

Using a kelly-saver sub in poor condition . . . In the course of drilling a well, the kelly sub mates with every box in the string. If in poor condition, it can bring on trouble in the boxes. Using a bad kelly saver has the same effect as running bad joints back into the ground.

High-torque fishing jobs, etc. . . . Running reversing tools, certain other fishing operations, and underreaming call for a high torque on the drill string. If the tool joints are worn and small in size (such as old slim-hole joints), their torsional strength may be less than that of the drill pipe. Then, the high torque can cause the tool joints to fail in torsion. The boxes may swell and split and the pins fail in tension.

How to make tool joints LAST LONGER

Break them in right . . . The first four or five trips that a new tool joint makes are the most important of its life. If it is handled right during those first few runs, it will have a much better chance of paying back its cost. The new joint will resist makeup more than an old one. For that reason it requires more dope than an old joint. The new joint must be cleaned and dried before being doped. When it is first run into the hole, it should be carefully doped with a good antigalling thread compound that contains at least 40 per cent of finely powdered metallic zinc or 50 per cent of finely powdered metallic lead by weight.

In making each trip after that, the box threads and shoulders should get another coat of the lubricant.

For the first few trips, the new joints should be made up by hand with the chain tongs and then followed with final makeup on the cathead. Avoid high-speed makeup with the spinning line which can cause galls or burned threads.

Do not f o r c e makeup of improperly engaged threads. When stabbed, the flat crests of new threads will sometimes wedge against each other. If they do, a little backup or pickup will free them.

Make joints up tight enough . . . To get tool joints made up tightly enough, get a torque indicator of some kind. It does not have to be used 100 per cent of the time—only often enough to make certain the cathead is pulling hard enough.

On the trip out of the hole, check the joints for tightness. If they break out too easily, they should be tonged up tighter on the next trip in. Where an automatic cathead is used, test the makeup once each trip by trying to make up a joint further to proper torque with the manual cathead. If the manual cathead will make up the joint further, something should be done to get the automatic cathead making up tightly enough.

Don't run bad joints back into hole . . . Mating a damaged pin with a good box and a damaged box with a good pin will only bring on more trouble, not less. If damage is slight, shoulders may be dressed off at the rig with hand tools. This should be done as soon as the damage is noticed in order to keep the bad joint from being put back into the hole by accident. If damage is too great, the joint should be laid down and taken to a machine shop for repair. Remember that the damage is not merely to the pin alone or to the box alone; both should be repaired.

Be careful of joints when tripping, moving, pulling up, laying down . . . A lot of tool-joint failure can be traced back to carelessness in handling. During breaking out of joints when coming out of the hole, the tension on the spring hook should let the pin jump clear of the box without striking the shoulder; it shouldn't be high enough to damage the threads from too high tension. Don't let the pin bump the box shoulder when stabbing. Be sure that the hook and elevators never hit the shoulder. Never use a wrench against pin shoulders to "jack" the stands on the floor.

See Fig. 25

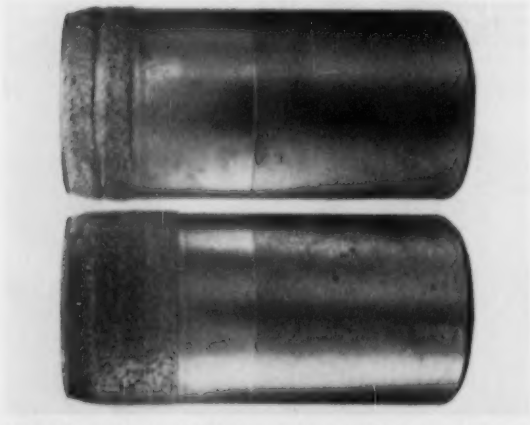
THREAD PROTECTORS pay off their purchase cost by keeping joints out of the shop. Protectors should be used when moving the pipe, racking it, pulling it up, and laying it down. Fig. 25.

LUBRICANT IS IMPORTANT to insure good makeup and to prevent thread galls. This is especially true with new joints which need more lubricant since they resist makeup more than do older joints. Fig. 26.

DRY CONNECTIONS mean something is wrong. Don't make mistake of switching such a pin to a good box and dry box to a good pin. Result is two bad joints instead of one; this practice can spread trouble throughout the string. Fig. 27.

MINOR DAMAGE CAN BE DRESSED OFF with hand tools on tool joints just as with drill collars. Such simple repair at rig will save cost of trucking entire joint to shop later for recutting. Fig. 28.

WATCH KELLY SAVER—if it is bad, it can damage every box in string. Keep rathole clean and it will help keep the kelly-saver sub in good condition. Also keep mouse hole clean; if it contains junk, it can damage every tool joint pin added to the string. Fig. 29.



HARDFACING LENGTHENS LIFE of tool joints. Here are two joints, one with two bands of material, the other with a continuous area made by putting on four bands closely spaced. Best time to put on hardfacing material is when joint is new. Fig. 30.

DRILLING . . . *EQUIPMENT*

Use a good thread protector when moving the pipe, pulling it up, or laying it down. Don't let threads or shoulders hit the steel work of the walk or ramp. Even wood walks pack splinters into the pin threads so tightly they are hard to remove.

Don't put the tongs onto the joints close enough to the shoulders that the shoulders are damaged. Don't force makeup on improperly engaged threads; a slight backup or pickup will free them.

Box and pin protectors are high in price but save money in recutting tool joints.

Lubricate threads right . . . Normal drilling operations call for a low-friction, antigalling compound. It should be put liberally on the threads and shoulders of the pins and boxes and spread with a brush. Don't rely on the pin to spread the dope into the box during makeup. Good use of thread lubricant is especially important on new joints.

See Fig. 26

Certain operations put an extremely high torque on the drill string—such as use of reversing tools, underreaming, and certain types of fishing jobs. For these operations, some recommend a high-friction compound to step up the joints' resistance to torsional failure. This compound can be made by adding 1 or 2 lb. of red lead to a gallon of kerosine.

Inspect the joints regularly . . . The most important inspection of tool joints is the one that should be made every time the pipe is pulled. The crew should watch for "dry" or "muddy" joints that are a tell-tale sign of leakage. These joints should be inspected closely and repaired if necessary. If the fault seems to be too-loose makeup, the pipe should be tonged more tightly on the next trip into the hole.

See Fig. 27

It is a good idea to come out of the hole on a different break each trip. In this way, the crew can look at every joint often and can spot little troubles before they get to be big ones.

When running the pipe into the hole, the crew should look for any damage to the box shoulders that might have occurred during previous handling.

See Fig. 28

Keep kelly-saver sub in good shape . . . The crew has the opportunity to look at the threads and shoulders on the kelly-saver sub many times each day. They should be sure it is in top condition to prevent its damaging tool-joint boxes. Keeping the rathole clean will keep the sub in good shape longer by keeping foreign matter out of the threads.

See Fig. 29

There's a case on record where a string of new joints was ruined by junk in the mouse hole. Every pin picked up was damaged.

Keep drill pipe straight and in tension . . . Periodic straightening of crooked drill pipe will prevent lopsided wear on the tool joints. Using enough drill collars to keep the pipe in tension will prevent excessive wear caused by the joint's being ground under compression into the walls of the hole.

It is not a good practice to put a crooked joint into the top of the string with the idea that high ten-

sion there will bring it back straight. The joint may be temporarily pulled straight but will likely remain crooked. And it may eventually wind up in the lower part of the string where its crook will cause trouble.

Slow down wear by hardfacing, other means . . . Hardfacing tool joints can double or triple their useful life by slowing down the rate of wear on the outside. The best time to apply hardfacing material is in the manufacturer's shop when the joints are new. Automatic machines do a good job in the field, but results are not so consistent as shop jobs. Manual application of hardfacing in the field is good but must be carefully done by an experienced welder.

Best results from field hardfacing comes with the unitized joints. Since they are thicker and have no threads underneath, heat penetration is not such a problem as with the screwed-on joints.

See Fig. 30

Wear sleeves are used successfully in some areas. But, if run too long, some sleeves are apt to "ring off" in the hole and bring on fishing jobs. If the sleeves are to be used, they should be put on by a reliable shop.

It may be that using oversize tool joints can solve the problem for some rigs by evening out the life of tool joints to that of the drill pipe.

Rubber pipe protectors, although mainly to protect casing in the hole, also cut down on the rate of wear of tool joints inside pipe.

Don't mate pins and boxes of different outside diameters . . . When new tool joints are put into the same string with older joints, the new joints should be kept together. This will prevent running into the hole a joint in which the new pin or box has a much greater outside diameter than the older, worn pin or box with which it mates.

When you BUY drill pipe . . .

Get it big enough for the job . . . In most areas, the mud pump is the key to faster drilling. And, in a sense, any pressure loss of the mud stream in the drill pipe is a waste. With high mud-volume rates, the only way to cut the pressure drop through the pipe is to increase its size. For that reason, drill pipe should be the largest possible for the type of hole to be cut.

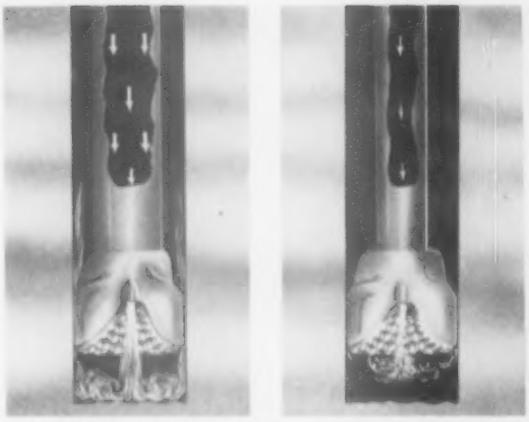
See Fig. 31

A.P.I. drill pipe is always sized according to the outside diameter. The extra thickness in heavy-weight pipe reduces the inside diameter.

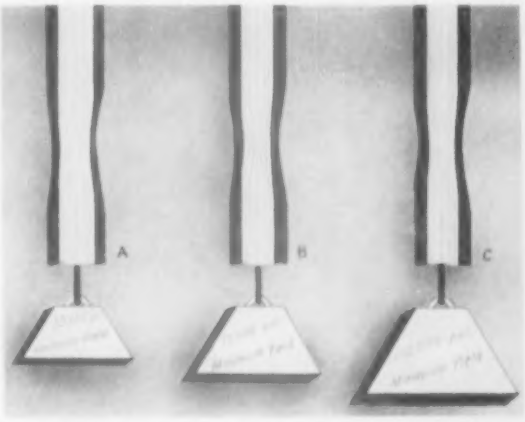
Think about tool joints . . . In specifying whether the drill pipe should be internally upset (I.U.), externally upset (E.U.), or both internally and externally upset (I.E.U.), you have to know what style tool joints you need. I.U. pipe takes regular, full-hole, extra-hole and slim-hole joints. E.U. pipe takes internal-flush joints in sizes as large as 4½ in. Internal-flush joints in some 4½-in. styles and in all sizes above 4½-in. need I.E.U. pipe.

If the pipe is to be used with unitized tool joints, it will have to be ordered plain end.

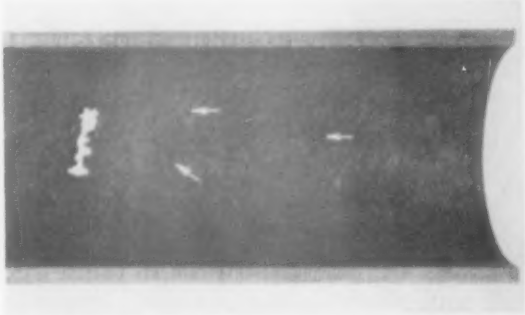
See the Tool Joint Section to determine which style joint and which pipe-to-joint connection you need.



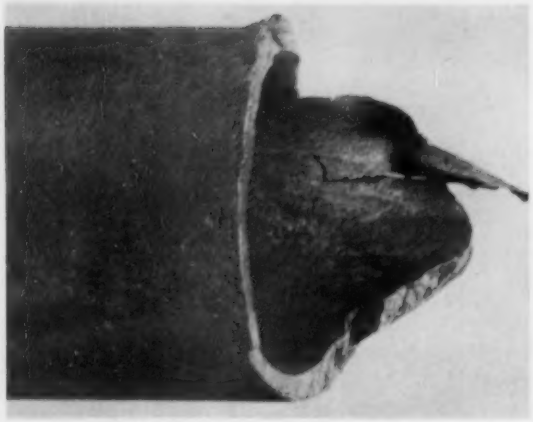
GET LARGEST PRACTICAL SIZE drill pipe for hole to be cut. Small-diameter causes high pressure loss in mud stream; it results in high pump pressures and makes jet drilling impossible at any but shallow depths. Larger pipe keeps down pump pressure, makes jet drilling possible at greater depths. Fig. 31.



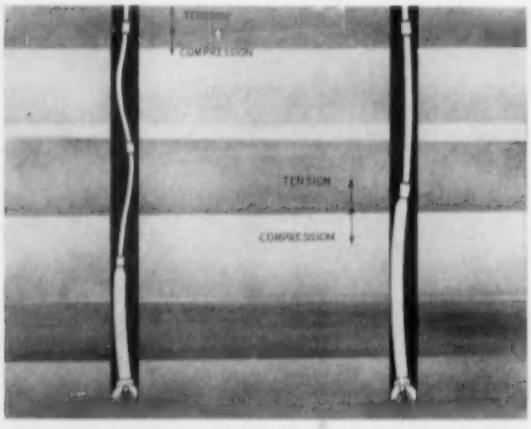
GRADES "D" AND "E" DRILL PIPE, the only A.P.I. standardized grades made, have minimum yield strengths of 55,000 and 75,000 psi., respectively. For deep drilling with high loads on drill string, manufacturers roll special high-strength pipe with a minimum yield of about 110,000 psi. Fig. 32.



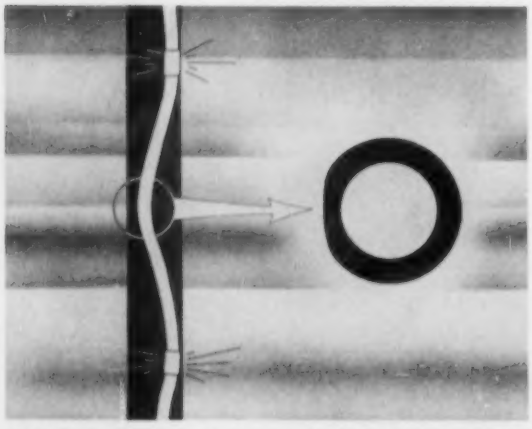
CORROSION FATIGUE caused cracks in this drill pipe. One of them has washed out. Note there are several other cracks which also result from corrosion fatigue. Fig. 33.



SLIP-NOTCH FAILURE of this joint of pipe caused a fishing job. Notice the deep transverse scars in foreground caused by letting pipe turn in table slips. Such notches can also be caused by careless handling or improper marking of pipe. Fig. 34.



RUNNING PIPE IN COMPRESSION grinds it into walls of hole, causing fast wear. Moreover, it puts high stresses on tool joints and brings on early fatigue failure. One of most common causes of crooked pipe is running it in compression. Fig. 35.



CROOKED DRILL PIPE will wear lopsided; so will tool joints on it. Moreover, the crook puts big bending loads on both pipe and joints making them more liable to failure by fatigue. Fig. 36.

DRILLING . . . *EQUIPMENT*

Get right grade, weight, and range . . . Presently, A.P.I. drill pipe comes in only two grades, "D" and "E." Grade D pipe has a lower yield and tensile strength than Grade E and is, of course, cheaper. Most shallow drilling does not bring the pipe close to the yield strength of Grade D pipe so it is, and should be, used for this service.

In wells 10,000 ft. and deeper, Grade E must be used because of its higher strength. For wells deeper than about 15,000 ft. the manufacturers have special high-strength pipe; it can be made with minimum yield strength 100,000-psi. and above about twice the yield of Grade D.

See Fig. 32

To take care of lighter or heavier service, each of the grades of drill pipe comes in several weights.

In some deep-drilling areas, contractors use a combination string which has two different weights or grades of pipe. The heavier or stronger pipe is used in the upper part of the string where the tensile load is highest. With such a combination, it's a good idea for the two weights of pipe to have different diameters so that they will not be mixed in the string.

A.P.I. drill pipe also comes in three ranges or lengths because of the way it is made. Range 3 pipe, longest, is rarely used because of the trouble in handling it in the derrick and in moving.

Why does drill pipe FAIL . . .

Fatigue . . . The vast majority of drill-pipe failures today result from one kind or another of fatigue. Very seldom is the failure due to "pure fatigue"—the simple bending back and forth of the pipe in the hole over a long period. The failures usually result from one of the two other types of fatigue discussed below.

Corrosion fatigue . . . Corrosion fatigue is the most common type of drill-pipe failure in the Permian basin, Mid-Continent, and many other areas. Corrosion—apparently due to a small amount of salt in the mud—eats pits into the pipe. These pits become stress raisers as the pipe bends under rotation, and a crack will develop at the bottom of some pits. Not all corrosion pits start cracks. But if the joint is corroded all over, a few will breed cracks, and the cracks bring on complete failure. Such failures usually occur near the pipe upset where the change in section causes high bending stress.

See Fig. 33

Drilling fluids which contain no salt do not lead to corrosion fatigue; neither do drilling fluids that are completely saturated with salt. It is those fluids which have only a small amount of salt—7 per cent is the worst concentration—that cause the trouble. This salt, of course, comes from drilling through salt and anhydrite beds.

Corrosion fatigue also leads to failure of the threaded connection between pipe and joint. A special kind of fatigue failure—called fretting corrosion—occurs at the end of the joint shrunk on pipe. This is caused by a slight working of the end of the joint over the pipe.

Running pipe in compression speeds failure by corrosion fatigue because it increases the stress in the pipe due to bending.

Notch fatigue . . . Any sharp-bottomed notch or cut crosswise on drill pipe is an open invitation to failure

and a fishing job. In the past, the worst offenders were the old-style slips which did not grip the pipe around its complete circumference. These slips had relatively few teeth and these dug into the pipe and made transverse notches. Such a notch, however formed, is a natural stress raiser and may bring cracking and failure quickly.

See Fig. 34

Notches and scratches up and down the pipe are not normally dangerous. These longitudinal marks—such as those put on by pipe tongs—do not raise the stress in bending. However, you should still never tong on the pipe—tong on tool joints only.

Most stress-raising transverse notches are a result of careless handling in the derrick or slip cutting such as when trying to rotate pipe with the table slips. Sometimes the notches can come from defects rolled into the pipe at the mill, from scratches by chips broken off bit teeth or junk that is embedded in the walls of the hole, or from abrasion by the formation itself. Other things which occasionally cause notches are electric-arc marks, stencil cuts, or machine-shop grips.

Running pipe in compression . . . Running pipe in compression is a good way to speed up both corrosion fatigue and notch failures. Not only that, but pipe in compression wears faster; the tool joints on it wear faster and fail sooner.

See Fig. 35

One of the biggest causes of crooked pipe is service just above the drill collars when there isn't enough collar weight to keep the pipe in tension. And crookedness also aggravates the conditions of corrosion and notch fatigue.

There are still some areas where pipe is run in compression without too disastrous results. These are areas where corrosion is no problem and wear is slow.

Running crooked pipe . . . Crooked pipe as it rotates in the hole comes in for great bending stress. Added to the effect of corrosion and notches, these extra stresses are often enough to cause cracks, washouts, and complete failure.

See Fig. 36

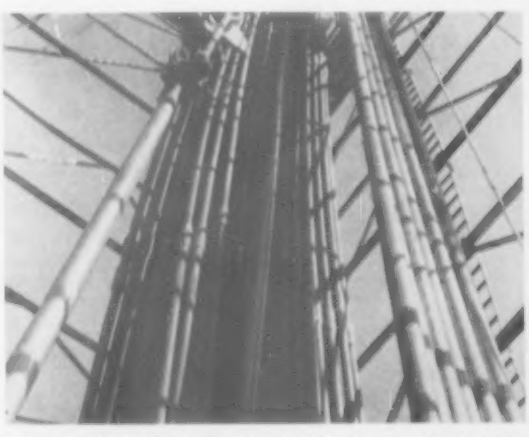
Even in areas where corrosion is no problem and when pipe is not notched, crooked joints wear lopsided quickly and must be discarded soon. Moreover, crooked pipe is bad for tool joints. It wears them quickly and can cause early failure of threaded connections between pipe and joints.

Wear . . . Even straight pipe wears. There is no general rule about how thin a joint can be worn before it is too dangerous to run. Depth of wells, presence of corrosion, and other things affect how hard the pipe is stressed and, as a result, how thin it can be worn.

Twistoffs . . . If there is a failure of the body of a joint of drill pipe in the hole, most drilling men call it a "twistoff." But, actually, it is seldom a case of the pipe simply twisting into, or failing in torsion. Almost always the pipe has been damaged by something—corrosion fatigue, notch fatigue, crookedness, etc.—and then fails due to bending in the hole.

Few rigs have enough power in their rotaries to twist in two any pipe but the very smallest sizes. Rock-bit drilling simply does not require that much torque.

COUNTERBORE WELDING will prevent most last-engaged-thread failures of screw-on tool joints. Unitized and shrink-fit joints have excellent records as safeguards against failure of tool joint to drill-pipe connection. Fig. 37.



USING ENOUGH DRILL COLLARS will keep the drill pipe in tension. Since the joints above collars get severe strains, this service should be rotated so no joint is there too long. Fig. 38.

KEEP PIPE STRAIGHTENED and it will pay off in longer service from it and its tool joints. Lay crooked joints aside; don't put them in the string expecting heavy load to straighten them out. This may hold them straight temporarily but it doesn't give them a permanent set. Fig. 39.

Last-engaged-thread failure . . . Unitized and shrunk-on tool joints have almost done away with failures on the drill-pipe and tool-joint connection. When there is a failure of this threaded connection between pipe and joint, it is usually aggravated by running the pipe in compression, by corrosion fatigue, or crooked pipe.

See Fig. 37

Crushing, pulling in two, etc. . . . In some cases, using tongs on the body of the pipe instead of on the tool joints can, of course, crush the pipe. So can careless setting in the slips when tripping long, heavy strings.

One of the main causes of "necked down" pipe is setting the slips while the string is still moving rapidly downward. Also worn bushings in the rotary cause uneven load on slip teeth and bring on pipe damage. On many deep holes, solid bushings have to be used to prevent this trouble. When pipe is stuck, pulling too hard on it will stretch it past the yield point. This causes the pipe to neck down and, in extreme cases, to pull completely in two.

Careless handling during moves can crook pipe. So can dropping during pulling up or laying down joints from the floor.

How to make your drill pipe LAST LONGER

Keep it in tension . . . Using enough drill collars to keep the pipe in tension will cut down on the number of notch-fatigue failures. It is especially important to keep pipe out of compression in areas where corrosion fatigue is bad.

Not only will pipe in tension have fewer fatigue failures, it will also wear more evenly and, hence, last longer.

See Fig. 38

It is a good practice to move the first few stands above the collars to a point higher in the string after every trip. This will even out the hardest service in the string among all the joints; as a result, failure from notch and corrosion fatigue will be slower in coming.

Keep it straight . . . Straight pipe will last longer because it wears more evenly and because it is not so subject to fatigue failure as crooked pipe.

See Fig. 39

Pipe can also be crooked by hitting a bridge while running in the hole at fast speed. Obviously, pipe should be run slowly when there's a chance of the hole bridging. Slow running not only helps the pipe but also prevents the pressure surges that are a common cause of lost circulation.

Also, during running or pulling pipe, the box end of the pipe can be kinked by setting it too high in the slips and tonging it carelessly. A little care by the crew in setting the pipe low in the slips and tonging it right will stop this cause of trouble. Care will also prevent pipe's being crooked by the jarring action of moving from location to location.

Protect it from corrosion . . . There is no single way to protect drill pipe from failure by corrosion fatigue. There are several things which, added together, will help.

It appears that sandblasting to remove mill scale is economically sound. The process is relatively cheap and removes particles of scale that act as small electrolytic cells. These cells result from the scale and steel being dissimilar materials and every piece of scale is a potential corrosion-pit producer.

Plastic coating of the inside of the pipe and use of corrosion inhibitors have sometimes been effective but have not been consistently economical.

Drill the salt section of the hole (if any) with a separate string of pipe. Then, the operators should be encouraged to case off these beds. If possible, use a different string in good condition for the deeper drilling and avoid salt contamination of the mud in that part of the hole. When laying down pipe run in salty drilling fluid, rinse it out with fresh, clear water.

The crew should make a visual inspection of the pipe on every trip, especially if the pipe is not regularly inspected by an outside firm.

These things should be done in combination with the other practices already mentioned—enough drill-collar weight, regular inspection, and keeping the pipe straight. Also, the pipe should be cleaned of corrosion products before it is inspected.

Avoid transverse scars . . . Transverse scars can make even relatively new pipe fail. So, joints with these scars crosswise of the pipe should be discarded or put into light service. To prevent the scars, never allow the pipe to turn in the table slips; be sure to use back-up tongs when there is not enough pipe hanging in the hole. If the pipe is to rotated with the slips, be sure it cannot turn and be cut by the slips.

Don't mark drill pipe . . . If you must mark the string, stencil on the base of the pin, the counterbore of the box, or on the elevator shoulder which is normally protected from wear.

To help you in choosing and maintaining your drill collars, tool joints, and drill pipe, the Journal is reprinting some of the A.P.I. standards for this equipment. Dimensions and styles of this equipment are in the tables on pages 165-169, immediately following the section on wire line which starts on the facing page. Keep them for your premanent reference.

HOW TO GET YOUR MONEY'S WORTH FROM YOUR

Drilling Line

• DESIGN • HANDLING • MAINTENANCE

Costs of maintaining a strong, safe drilling line can be reduced. Good design, careful handling, and regular maintenance are keys to longer line life. The following pages describe such practices. Use this information to keep your drilling costs down.

BY J. O. SCOTT, JOURNAL DISTRICT EDITOR

JOE'S in the drilling business. He figures that this reel of wire rope is going to make him some money. Even though he's getting the going price for drilling he can shave his costs by getting more wells out of his drilling line.

Joe believes in treating equipment right and his crews know what it takes. They know that wire rope works just like a machine and they treat it with the same care as engines, pumps, or draw works. On Joe's rigs the reeving and hoisting system is designed for the rope used. Sheaves are large in diameter. Drums are grooved and big enough that the line never has to fill more than several layers. Wire-line guides and rollers keep line vibration down.

Joe's drillers don't bounce the load around when they're running pipe in and out of the hole. And they don't overload the drilling line. It lasts much longer that way. And they make sure it's always lubricated.

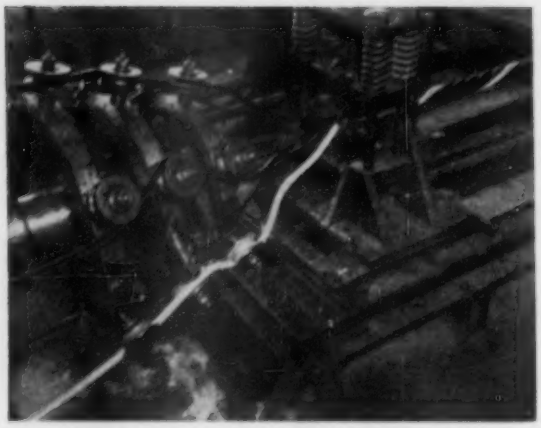
Now this reel of wire rope that Joe just bought has a bit more line than many others use. Joe knows that his line expense is less when he buys long lengths. Then he can get maximum work out of practically all the line. He knows that to do this, however, he must use a regular slip and cutoff practice. He plans the moves so that no part of the line ever fails while it is in the reeving. Yet when the crews cut it off at the drum end it has always just become worn out.

Wear on Joe's lines is always uniform because Joe's crews know the value of caring for and inspecting the line regularly. If it is on the reel they make sure it isn't nicked or pinched. They never let a kink or dog-leg form. They make sure the dead-line clamp is always firm yet doesn't crush the rope. And they always have a sharp eye out for sheave wear or bearing failure which could make wires break in a hurry.

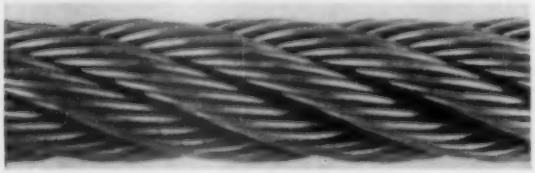
If Joe gets more work out of his drilling lines than you do then its probably because you're not taking the best care of your lines. Maybe your hoisting system is planned badly. Or maybe you need a better cutoff practice. Well. Joe doesn't need to have an advantage. Here in this article you'll find out some of the reasons why.

This is a collection of practical information about your drilling line and its related equipment. It will help you to understand your drilling line and to keep that life line at its best.

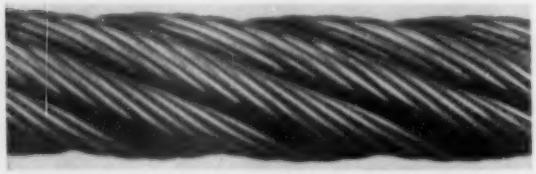
AN ORIGINAL COPYRIGHTED FEATURE OF THE OIL AND GAS JOURNAL



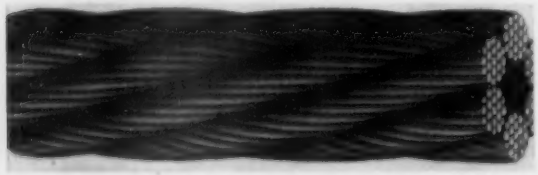
PREFORMED STRANDS are set in a helical shape as they are wound together. Preformed rope is easy to handle. Wires don't wicker or fly apart when they are broken or cut. Rope has high fatigue resistance.



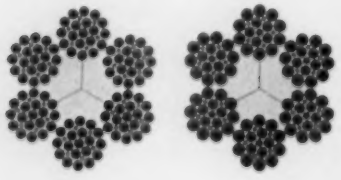
RIGHT REGULAR LAY is the prevalent rope used for rotary drilling.



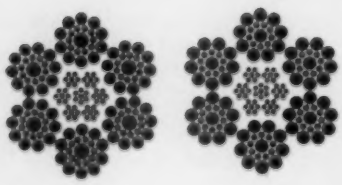
RIGHT LANG LAY has strands as well as wires curling to the right.



LEFT REGULAR LAY has strands rotating to the left but wires rotate in opposite direction.



6 x 25 FW (FC), left, has strand with outer layer of 12 large wires over filler and center wires. 6 x 21 FW (FC) has 10 large wires over filler, intermediate and central wires.



6 x 21 SEALE (IWRC), left, has strand of 10 large wires over 10 small wires and a center wire. 6 x 19 SEALE (IWRC) has nine large wires over nine small wires and center wire.

What IS wire rope?

YOUR drilling line is an intricate network of close-tolerance, precisely made steel wires. Much like a machine, each of these parts has a job to do and each must work in perfect relationship with the other parts for the rope to function properly. And, as with a machine, each part of the wire rope must be safeguarded through proper care and handling for the rope to give highest service and life.

First consideration for making wire rope is the selection of steel. Wire rope is made from cold-drawn carbon steel of different grades depending on the strength. A.P.I. classified grades are improved plow steel (IPS), plow steel (PS), and mild plow steel. Only the first two higher-strength grades are used for drilling line because of the rugged service required. An even higher-strength steel, about 15 per cent stronger than IPS, is also now being used for drilling line.

Parts . . . The basic element of the wire rope is the individual wires. These wires are first carefully cleaned and sized and then are wound into the strand. The winding is a process somewhat like braiding in that the wires are laid into the strand, not twisted. After the stranding, the strands are wound or laid together around a core to form the rope. The core may be a fiber rope (FC), a plastic core, an independent wire rope (IWRC), a spring-steel coil, or a multiple-wire strand. The independent wire rope core is the most widely used because of its resistance to crushing and distortion, a feature also of the spring steel coil.

As the strands are wound together into the rope they may sometimes be purposely preset into a helical shape. The result is called preformed (PF) wire rope. It looks no different from the nonpreformed (NPF) rope but has the advantage of being unstressed when at rest and thus easier to handle. Wires and strands of a cut preformed rope will not fly apart. The preforming also helps to eliminate vibration, lets the rope wind tighter and more evenly, and increases fatigue resistance.

Design . . . Most rotary-drilling lines are right regular lay. The lay of the wire rope refers to the direction of the rotation of the wires in the strands or of the strands in the rope. As shown in the illustrations, in a right-lay (RL) rope the strands rotate clockwise while in a left-lay rope they rotate counterclockwise. Regular lay means that the wires in the strands rotate in the opposite direction from the strand rotation. When the wires rotate in the same direction as the strands the rope is called Lang lay. Regular rather than Lang lay is used for rotary drilling lines because it has less tendency to twist or spin under load and because it will withstand drum winding more successfully.

Types of wire rope are designated by a number such as 6x19. The first number is the strands that make up the rope and the second number is the wires in each strand. Following this number may be a further description such as Seale or filler wire (FW) Types U and W. This designation refers to the design of the strand, as shown in the drawings, where smaller wires are wound in among the large wires. The large outer wires help resist abrasion while the small wires inside the strand provide resistance to crushing by supporting the outer wires.

Commonly used wire ropes for light duty such as for coring or slim-hole rotaries range from 6x19 Seale to 6x25 FW. Heavy-duty rotary rigs will normally use

6x19 Seale through 6x21 FW, and 6x21 Seale may be used in some instances. The greater the number of wires in the strand the higher is the flexibility but the lower is the resistance to abrasion and crushing. Likewise, the Seale construction is less flexible but more resistant to abrasion than filler-wire construction because it has larger outer wires.

Your reeving system . . . What it does . . .

Your hoisting system is a way of lifting heavy loads with lighter pulling loads. As with a simple pulley system, the lines strung through the blocks allow you a mechanical lifting advantage. This advantage is equal to the number of lines strung between the crown and traveling blocks.

Thus for a four-line system without friction you can lift a weight by pulling with a force of only a fourth of the weight. With a six-line system the pull will be only a sixth of the weight; with eight lines, an eighth, etc.

The reason for this is that the lines emerging from the traveling block divide the load equally among themselves. And by pulling on the end of the line you need only exert the same force that is pulling down on this line as it leaves the traveling block. This is the load divided by the number of lines strung.

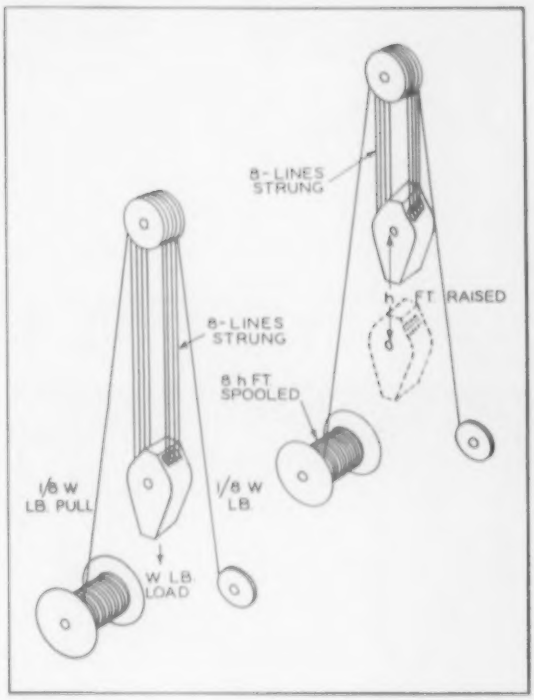
Work not changed . . . By using the mechanical advantage of the pulley you are not decreasing the work done, however. The work is the load multiplied by the distance it moves. When the load is hoisted, each of the lines shortens by the distance of the hoist. But the last line, the line spooling on the drum, must take up all of the extra line. This is, of course, the distance the load moves times the number of lines strung. Since the load on this line is the weight lifted divided by the number of lines, then the work done by the hoist is the same as the work required to raise the load.

Since the movement of the drilling line being wound or unwound on the drum is greater than the movement of the traveling block, the speed with which it moves is also greater. Thus, if the traveling block is being lowered at the rate of 10 ft. per second by a six-line system, the line is paying off the drum at 60 ft. per second or 3,600 ft. per minute. Maximum recommended speed for movement of wire rope through the sheaves is 4,000 ft. per minute. If the block of an eight-line system were moving at 10 ft. per second the line speed would exceed the recommended rate.

How much can you pull?

Actually, the draw works has to pull more than the weight of the load divided by the number of lines between the blocks. The pulling force is increased by friction of the sheave bearings and the bending of the line over the sheaves. This extra force amounts to about 2.0 to 2.5 per cent of the load on the line passing through the sheave.

For a rotary-rig reeving system there are the same number of active sheaves as there are lines strung. Thus, starting with the line at the deadline sheave, each successive line has during hoisting an extra load on it



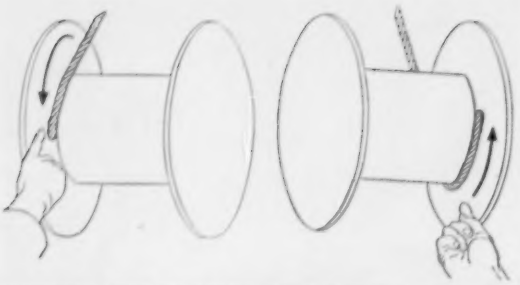
MECHANICAL ADVANTAGE of the block and tackle is the number of lines strung between blocks. Pulling load is less than load lifted but length of line spooled is greater than the distance the load moves.

Allowable hook loads for rotary drilling lines

(for IPS, IWRC, wire rope—deduct 15 per cent for PS and 7.5 per cent for FC):

Rope size (in.)	Single line strength (lb.)	No. lines strung	Allowable load, lb.* Safety factor 3	4	5	6
⅞	69,240	4	83,800	62,900	50,300	41,900
		6	120,000	90,100	72,100	60,000
		8	154,000	115,000	92,300	76,800
		10	184,000	138,000	111,000	92,300
1	89,880	4	109,000	81,600	65,300	54,500
		6	156,000	117,000	93,600	78,000
		8	199,000	150,000	120,000	100,000
		10	240,000	180,000	144,000	120,000
1⅛	113,100	4	137,000	103,000	82,200	68,500
		6	196,000	147,000	118,000	98,200
		8	251,000	188,000	151,000	126,000
		10	302,000	226,000	181,000	151,000
		12	349,000	262,000	209,000	174,000
1¼	138,900	4	168,000	126,000	101,000	84,200
		6	241,000	181,000	145,000	120,000
		8	309,000	232,000	185,000	154,000
		10	371,000	278,000	222,000	185,000
		12	429,000	322,000	257,000	214,000
1⅜	167,060	4	202,000	152,000	117,000	101,000
		6	290,000	217,000	174,000	145,000
		8	371,000	278,000	223,000	185,000
		10	445,000	334,000	267,000	222,000
		12	515,000	387,000	309,000	258,000
1½	197,800	6	344,000	258,000	207,000	172,000
		8	440,000	330,000	265,000	220,000
		10	528,000	396,000	318,000	264,000
		12	611,000	458,000	368,000	305,000

*Includes weight of traveling block and hook.

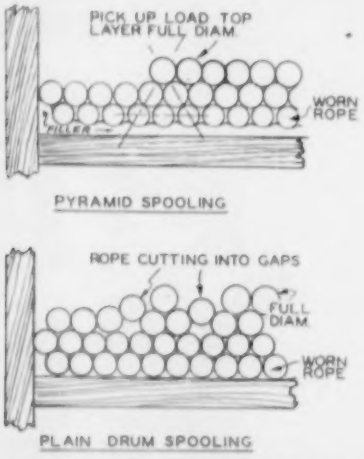


WINDING LINE ON DRUM. For right-lay rope use your right hand. Point your index finger toward on-winding line and thumb in direction of rotation. Starting side is next to your finger and thumb.

POOR SPOOLING on drum may leave gap such as this which lets later layer of line cut it and wear excessively. Smooth-face drums increase the chance of this.

CRUSHED LINE results from poor spooling and cutting in. Most likely a lower layer on drum.

WORKED TOO LONG in a crossover position the line will suffer severe wear and wire breakage. This is where an upper wrap must cross a lower wrap.



PARALLEL GROOVING lets less-worked, larger-diameter line spool evenly in a pyramid fashion. Without grooving more worn line packs tightly and less worn line may jump wraps.

equal to the sum of the frictional loads on all previous active sheaves.

The total actual load on the fast line, therefore, is the weight lifted divided by the lines strung plus this load times the number of lines strung times the friction coefficient, or:

$$L = W/N + W/N \times N \times F = W(1/N + F)$$

Allowable loads for different drilling lines with varying numbers of lines strung are shown in the accompanying table. The friction coefficient used is 2.5 per cent. The strength of the lines is based on improved plow steel with an independent wire-rope core. For plow steel with a wire-rope core the strengths and loads will be 15 per cent lower. For fiber core rather than wire-rope core the strengths and loads will be 7.5 per cent lower. The safety factor is a number by which the strength is reduced to obtain the allowable load. By increasing the safety factor, the allowable load is decreased but the service of the line is increased.

The draw-works drum . . .

What happens to the drilling line as it spools? Should the drum be grooved?

Some of the toughest abuse that the rotary drilling line gets is while it is spooling on the drum. At the crossover points and at the place where the rope jumps from one layer to the next at the flange, wear may be severe. In the portion of the line that spools last when the blocks are raised unloaded, terrific scrubbing and wear occur when the load of the drill string is suddenly lifted. And, in the portion of the line that lays next to the drum and has to withstand the loading of all the other layers, crushing is considerable.

Spooling . . . On flat or smooth-face drums one of the biggest problems is to get the line to spool evenly and snugly. Unless the rope is started correctly, the turns in the first layer may tend to spread apart which will cause cutting in of subsequent layers and result in flattened or crushed rope.

For right-lay rope you can determine the proper way to start the line by means of your right hand. For overwind on the drum your palm should be down. Then your thumb will point in the direction of rotation and your index finger will point toward the on-winding line. The correct side for the line to be started on is the flange next to your index finger and thumb. In this case, this is the left side.

For underwinding the drum use the same principle—thumb in the direction of rotation and index finger pointing toward line. The palm will be up in this case and the starting point on the right. With left-lay line you use the same principle only with your left hand.

Poor spooling can sometimes be traced to the way the line leaves the dead-end side of the drum. If it leaves the flange at too great an angle it may maintain this angle all across the drum so that it leaves a big gap at the opposite flange. Successive layers of line cross over this line sharply and will also tend to cut in at the gaps. Line crushing and shorter life result. It is important to get the first drum layer full and tight so it will support succeeding layers.

One way to correct a chronic condition of faulty drum winding is by means of a riser strip or spooling

wedge on the dead-end side. The strip is as high as the rope diameter and tapers from zero to the diameter of the rope in width. Since it travels flush around the dead-end flange it keeps the first wrap straight and eliminates the gap at the other flange. Piling up of wraps at the flange is prevented by turn-back rollers.

Grooved drums . . . Wear due to the crossing over of a wrap of line on a lower layer by a wrap of line on the next layer cannot be avoided. But it can be reduced by controlled spooling. This is provided by grooved drums.

With any type of spooling there must necessarily be at least one point of crossover with each lap. For, as a lower layer proceeds in one direction across the spool, the next layer must proceed in the other direction. Along most of a turn the upper wrap rides in the groove between two wraps of the lower layer. Then it must leave this groove in order to cross to the next groove and in doing so crosses over a wrap of the line in the lower layer.

However, with plain drums and where a practice of wire-line slipping is followed, newer rope is spooled onto worn rope. The worn rope has a smaller diameter and when it is wound up tight the new line will not track. The new line instead will jump a wrap and leave a gap into which the line of the next layer will cut.

Pyramid spooling . . . Grooving allows an upper layer of line to track a lower even if the lower layer is worn. Thus cutting in is reduced. However, it is necessary that the grooving include fillers at each end so that when the second and third layers start, they start smoothly and leave no gap for cutting in.

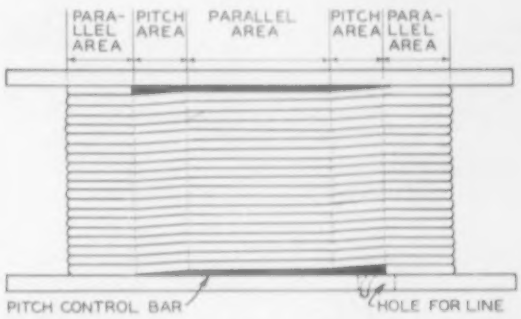
One of the most important improvements to spooling methods is the LeBus system. This is a grooving system where the crossover points are controlled. Instead of having a helical shape (like a coiled spring) from one flange to the other, most of the grooves are parallel to the drum flanges. As the crossover points pitch changes rapidly so that the line is crossed from one groove to the next. This leads to a controlled pyramid spooling as shown in the illustration. Cutting in is minimized because most of the line in every wrap is parallel and there is no tendency for the line to slip over.

Counterbalance . . . A good deal of the vibration of the drum and wire line at high speeds results from the eccentricity of the spooled line on the drum when only one crossover point is present. As the illustration shows, this makes the center of gravity slightly off the center of the drum. Another development to overcome this problem is counterbalance spooling.

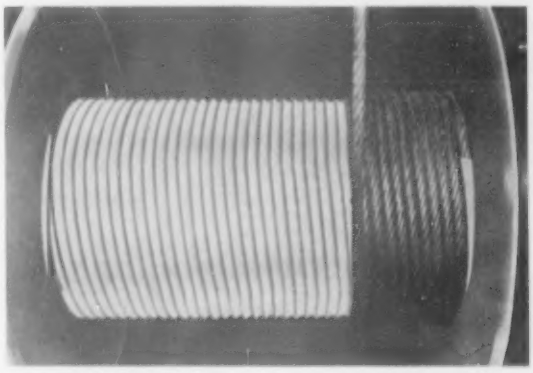
Counterbalance spooling consists of two crossover points on opposite sides of the drum. This is achieved by making the pitch at each crossover point only half that of the single-crossover drum. Grooves are still parallel but those on one side of the drum are displaced half a groove width from those on the other side. Special pitch-control bars at the flanges form the line to move over only half a line width.

Block and hook weight . . . If slack line gets into the spooling system it will cause severe wear because of cutting in and scrubbing of one layer against the next. This condition is most likely to occur during the running of pipe back into the hole when the traveling block is brought up fast and with no load but the weight of the

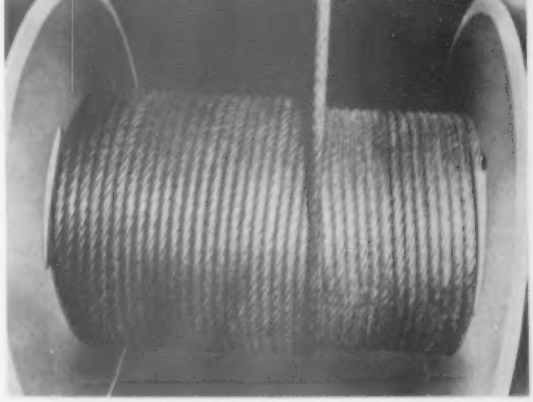
COUNTERBALANCED SPOOLING, left, provides line crossover on opposite sides of drum, leads to smoother drum operation. One crossover per wrap, right, unbalances drum.



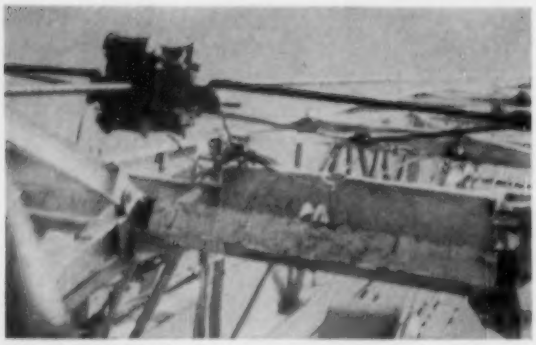
GROOVING for parallel wraps has pitched section for controlled crossover. The two pitched sections are for counterbalanced spooling. Drawing is flat layout of complete circumference.



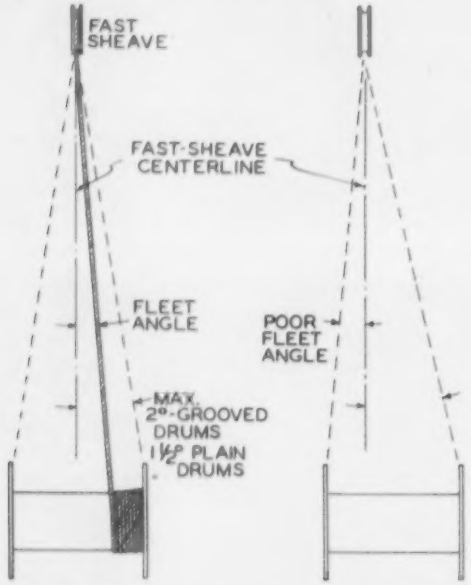
PICKUP POSITION with grooved drum requires only six to nine wraps. Line spools evenly across drum without having to be hammered tight.



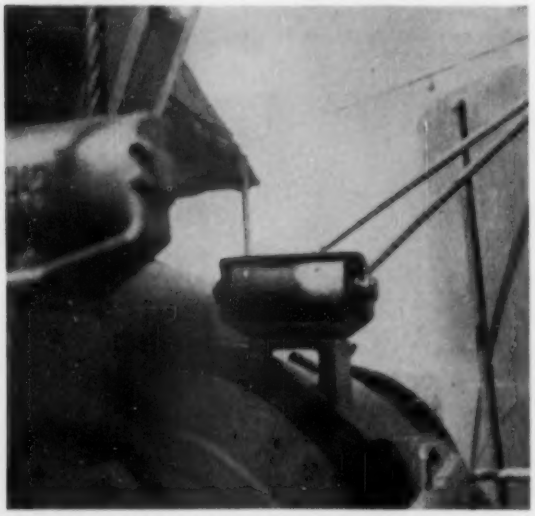
SECOND LAYER of line spooled on parallel grooving system stays in the valley between lower wraps until it reaches crossover point.



DRILLING-LINE STABILIZER stops line whip, helps spooling and prevents a lot of vibration during hoisting. It should be about 25 ft. above drum. Weight boxes attached to it may be adjusted to counteract bad fleet angle.



FLEET ANGLE can cause abrasion of line and uneven wear of fast sheave. Recommended maximum is 1½° to 2°.



TURN-BACK ROLLERS help kick the line back for correct crossover of successive layers. If fleet angle is bad they help prevent line from stacking up against drum flange.

block and hook to hold the line in tension. When the full load of the drill string is picked up from this position the top layers on the drum cut into the loosely spooled layers. To keep the line tight and minimize the spooling damage to the line it is important to use a heavy traveling block and hook.

Equally important as a heavy block and hook is the way the driller brings the unloaded block up to the top pickup position. If the clutch and brakes are not handled properly, slack line will occur between drum and fast crown-block sheave. To keep this from happening the driller should throw out the clutch a moment before taking his foot off the engine throttle. This lets the drum coast at traveling-block speed until the block loses momentum and slows down.

Line whip . . . Because of the speed of the fast line running onto and off the drum it will whip badly unless controlled. Irregular spooling on the drum is a big reason for whip.

However, whipping also causes poor spooling. The parallel spooling system has helped to reduce this factor but with any system wire-line stabilizers and weight boxes should be used to keep whipping to a minimum.

Fleet angle . . . When a wire rope is led from the drum onto the fast sheave it is parallel to the sheave groove only when it is at one point on the drum—usually the center. As the rope moves from this point either way, an angle is created which starts wear on the side of the rope and may cause poor spooling. This angle is called the fleet angle.

The fleet angle is necessary but should be held to a minimum. Experience shows that it should be held to less than 1½° for plain drums and less than 2° for grooved drums. Any greater angle creates needless wear on the sides of the rope. This holds true for either grooved or smooth drums.

To check the fleet angle, remember that an angle of 1½° gives a displacement from center of about 1 ft. for each 40 ft. of distance from the drum to the fast sheave. If the drum were 3 ft. wide, the maximum distance from center would be 1½ ft. Then to obtain a fleet angle less than 1½° the distance from the drum to the fast sheave would have to be greater than 1½ times 40 or 60 ft. An angle of 2° gives a displacement of 1 ft. over about 30 ft. of distance.

Stringing the line . . .

Blocks should be strung so that wear of the line against the sides of the sheave grooves is minimized. In leading the rope from the reel to the first crown sheave be sure that it doesn't rub against the rig structure. Snatch blocks used to keep it from rubbing should have as large a diameter as possible. Undersized snatch blocks can cause crankiness in a line.

Guard also against kinking of the rope by providing a horizontal axle for the reel to turn on while rope is being unreeled. Keep the line in tension. Don't ever pull line off a fixed reel. A loop may easily form in the line. If a loop should occur throw it out immediately. Otherwise it may be pulled tight into a kink. Even though the kink can be pulled out straight so that it isn't evident, the damage is already done and premature failure is likely.

Line fatigue is most serious at the dead-line anchor and dead-line sheave but it can be aggravated by reverse

bending between these points. Reverse bending at the dead-line holddown or too small a diameter of the dead-line drum may make the line cranky or produce a set in the line which will cause it to wear excessively when it moves on up into the reeving.

Proper steps in stringing the line . . .

. . . **Hang** the traveling block from a single line or otherwise support it in a vertical position. The best position in which to hang it is where the elevators are in pickup position near the rotary table.

. . . **Mount** the reel of new rope in its permanent position near the tie-down device so that the rope leads directly to the first crown sheave. Don't let the rope rub against the derrick girts or floor joists when it's pulled forward, even if you must remove the floor boards. Snatch blocks with suitable sheave size may be used to keep the rope away. Make sure the reel mount is solid and that the reel can turn easily.

. . . **Don't** let the rope drag on the ground. Sand and dirt which stick to the rope lubricant will later work inside the rope.

. . . **Brake** the reel flanges so that the rope doesn't become loose on the reel while being unwound and so an even tension is applied on the rope between the blocks. Don't apply the brake on the rope itself. A 2 by 12 with a man on the end makes a good brake.

. . . **Now** to start the rope, remove the old rope from the dead-line anchor and fasten it to the new rope with a swivel grip. This grip becomes tighter, the more the load it carries. And it keeps a twist in the old line from being transferred to the new one.

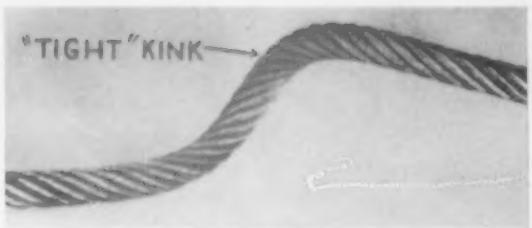
. . . **Wind** all of the old rope on the draw-works drum and pull enough of the new rope through to permit attaching it to the drum. Keep as much back tension on the rope as possible because slackness can damage the line.

. . . **Fasten** the new line so that it will not run back through the reeving and take off the swivel grip. Then take the old line off the drum and transfer it to the storage reel.

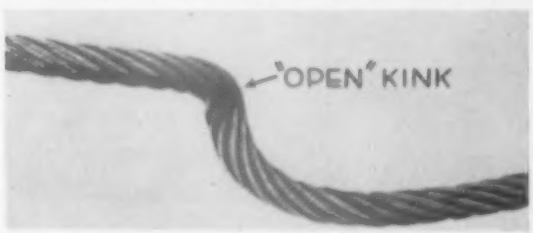
. . . **Attach** the new line to the draw-works drum and put on enough wraps so that the proper number will be on the drum at the pickup position. Then fasten the line to the dead-line anchor. When the traveling block is at the lower pickup point, six to nine wraps should be on the drum if it is grooved. For a plain-faced drum, a full layer of line plus four to six turns on the second layer is needed. After anchoring the dead-line end, raise the traveling block and take off the supporting line. The block, hook, and elevators may then be lowered through the V-door far enough to unreel the line on the drum so that it can be rereeled tightly.

Dead-line anchor . . . Holddown sheaves are the best way to anchor the line when it is to be moved through the reeving for extra service. These should be of sufficient diameter to prevent dog-legging the line (at least 12 times the rope diameter). The line should go around the holddown sheave in the same direction as it comes over the dead-line sheave and from the storage reel.

Never anchor the dead end of the line to a wooden or steel joist if you plan to slip the line. Such treatment will put severe dog legs in the line which later cause premature failure when this part is later put

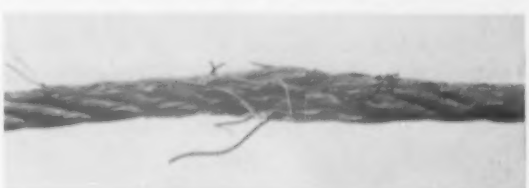


A LOOP IN THE LINE may hurt it in this manner . . .



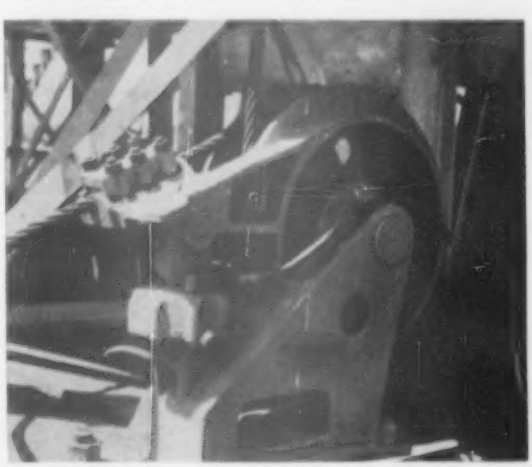
. . . or in this way . . .

. . . overstraining the wires, so that . . .

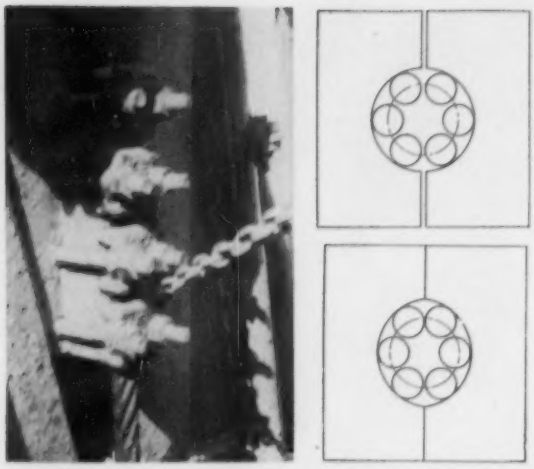


. . . line fails early in service.

SWIVEL GRIP is for pulling new line through reeving. A twist in the old rope is not put in new rope.

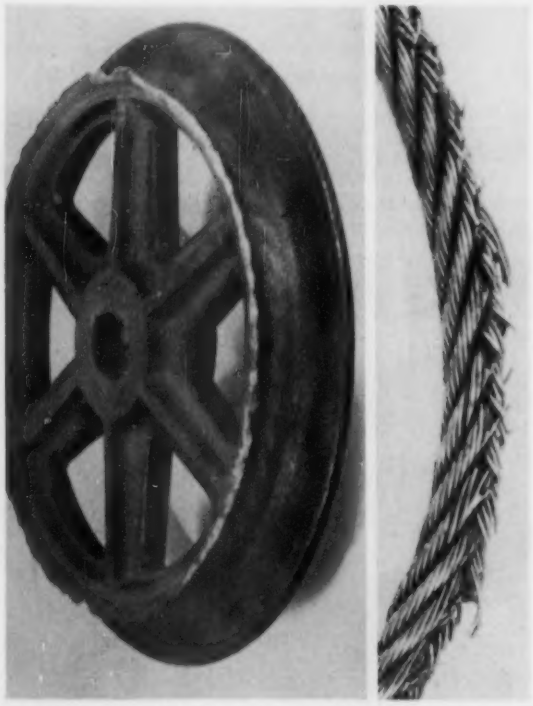


DEAD-LINE ANCHOR should have a large diameter to prevent dog-legging the line and should allow drilling line to be slipped forward easily.



ANCHOR CLAMPS must be inspected to see that they do not warp or crush the rope and shorten its life in later service. Clamp in top drawing evenly supports rope while that in lower drawing distorts it.

CORRUGATED SHEAVES and drums as well are hard on drilling line. They abrade it and make it fail prematurely.



PINCHED LINE might have been avoided by regular inspection program. A worn line cuts into sheave groove and the smaller groove may pinch and abrade new line.

into service. Also be sure that the dead-line clamps do not kink, flatten, or crush the rope.

Sheave shimmy, vibration cost line life

Vibration causes drilling line fatigue and shortens line life. Failure because of vibration is most serious at the dead-line sheave. This stationary point must absorb all the excess energy caused by line whip and vibration. Be sure the reeving system minimizes vibration.

Considerable line whip results from the fast line movement of the spooling process unless proper wireline guides are used. As the line goes through the sheaves, its momentum tends to throw it outward, much as a car rounding a curve on the highway. It is prevented from doing this, however, by the line tension. But this sudden angular acceleration and deceleration will start vibrations. And in a long, unsupported, fast moving, flexible line this can result in severe whipping.

Wobbling or shimmying sheaves can also induce vibration in the drilling line. This probably won't lead to whipping if it involves the lines between the blocks, but it represents energy which can weaken the drilling line. Wobble will also cause the line to receive abnormal wear from the sides of the sheave to further reduce its life.

Lack of attention is the usual reason for sheave shimmy. It's a sign of abnormal wear on the sheave bearing and probably the result of insufficient lubrication.

Worn sheaves, worn drum . . . Less line life

Corrugated sheaves and corrugated drum are a sign that you won't get top performance from the drilling line. Sheave grooves that have been cut in by worn rope are going to shorten the life of new rope, also.

Equipment that isn't properly maintained not only wears itself out early but helps destroy the wire rope in the process. Reasonably frequent inspection of the equipment to determine its operating condition and replacement of worn or broken parts is actually economy in rig operation.

Corrugations . . . Rope wire will leave imprints on the drum and sheaves if it is operated very long with heavy loads or if the metal is too soft. When radial pressure corrugates a groove in this way there is a filing action during every start and stop. If a new rope is installed after such corrugations form, its lay probably won't fit the imprints left by the worn rope and very rapid wear will take place.

When these danger signs are found, it is economical to have the grooves turned smooth. In some cases sheaves should be replaced. In replacing the sheaves make sure that the metal is sufficiently hard to take the necessary loading. Cast steel can stand only about 900 psi. of pressure but manganese steel will take up to 2,000 psi. and withstand wear much longer. If corrugations are occurring even with the best steel, chances are that the rope diameter is too small for the work load or not enough lines are being used between the blocks.

Groove size . . . Grooves on both sheaves and drum should be maintained within fairly close limits to get

good wire-rope service. A new rope will usually caliper slightly larger than its specified size and the groove in turn should always be larger than the calipered size of the rope. However, if it is too much larger it will not support the rope properly and the rope will flatten under load.

If the groove is too small it will cause distortion by pinching the rope. Not only will there be excessive abrasion but the wires and strands bend against each other and can't readjust themselves properly to distribute the load. Grooves for drilling line should be within the following limits:

	Sheave oversize, in.	
Nominal rope diameter, in.:	Minimum	New grooves
⅞ to 1⅛	3/128	5/64 to 1/8
1¼ to 1½	1/32	7/64 to 11/64

Depth of the groove for a sheave should be 1¾ times the rope diameter. The groove should support the rope over a minimum of 150°. Grooves for drums should not be over 20 per cent of the rope diameter. Deeper grooves cause too much distortion of the rope at the points of crossover.

Worn grooves . . . Sheave grooves wear smaller, not larger. This is because both sheave and rope wear in service. As the rope wears, it becomes smaller in diameter and the groove wears to fit the smaller rope size.

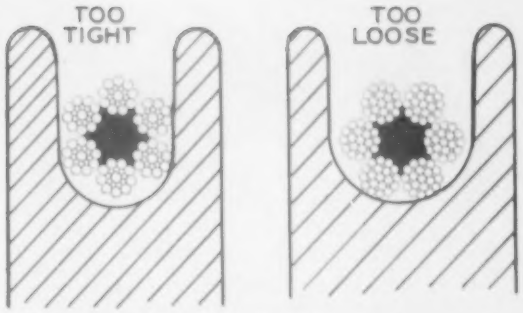
Worn grooves cause both pinching and abrasion of the drilling line. Pinching binds the wires so that they do not carry load equally. Pinched crown wires contacting the grooves cold work to the extent that they lose toughness and begin to crack up. Severe cold working coupled with abrasion can cause overheating of the line to high enough temperatures so that the steel structure is actually changed to a brittle form. Usually such burning occurs on the surface of the outer wires. But they will crack when bent and the cracks go down into the good metal to cause complete wire breakage.

Proper measurement of sheave grooves can be easily made by go and no-go gages. These tell you in a minute if grooves are right for the drilling line. In addition to measuring the grooves, you should check for uneven wear. Out-of-round sheaves will set up vibrations that cause early fatigue of the wires.

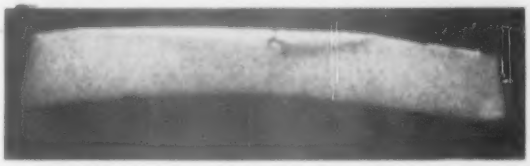
Other abuse . . . Insufficient lubrication can cause much sheave trouble and drilling-line wear. If the sheaves don't turn freely they will allow the line to slip. This not only wears the rope but heats it up so that it burns. The result to the sheave is usually a flat spot or out-of-round wear that will lead to more trouble even when the sheave is freed up.

Worn-out bearings can hurt the drilling line. If a sheave runs on such bearings for long, it will develop a wobble and even become misaligned with the other sheaves. Wobble sets up vibrations and causes abrasion of the rope. A misaligned sheave wears the rope rapidly. Uneven groove shoulder wear is always proof of sheave misalignment.

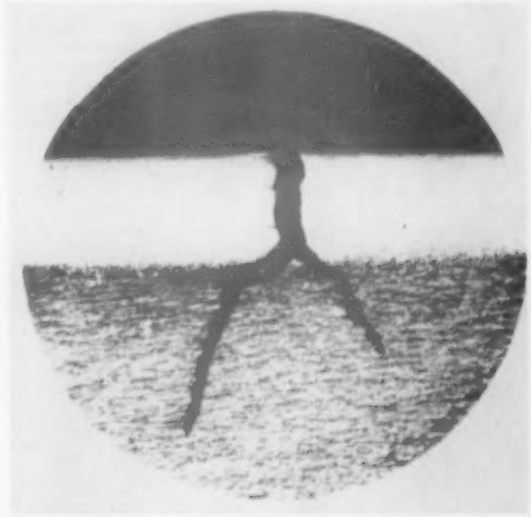
Broken flanges on sheaves should not be tolerated under any circumstances. Such a condition may easily lead the rope to jump the sheave, become frozen, and possibly break due to sudden shock. A dropped load or flying line could easily be disastrous to equipment and personnel on the rig.



SHEAVE GROOVES must neither be too small nor too large or the line will be hurt. Small grooves cause pinching and overheating and large grooves let line become flattened.

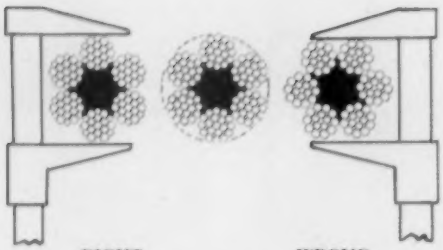


OVERHEATED LINE can result in the changing of metal structure to a brittle, martensitic type. The change can be seen in this crown wire.

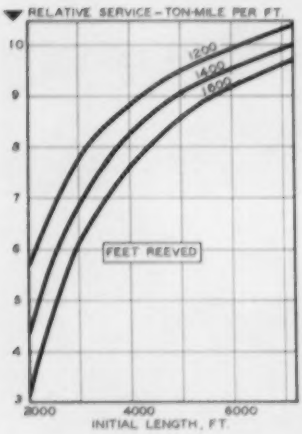


BURNED WIRE magnified many times shows how breaks can start in the brittle metal and extend down into good metal causing complete wire failure.

INSPECT SHEAVES REGULARLY to make sure that grooves don't become too worn. Bad bearings can cause serious line abrasion and set up vibrations which cause wire fatigue and early failure.

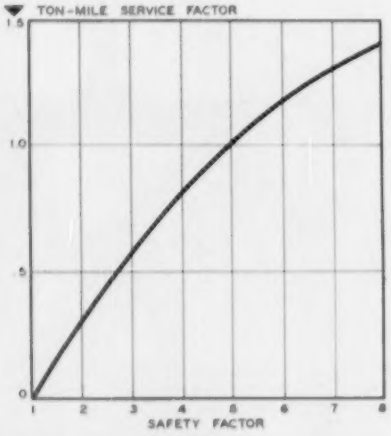


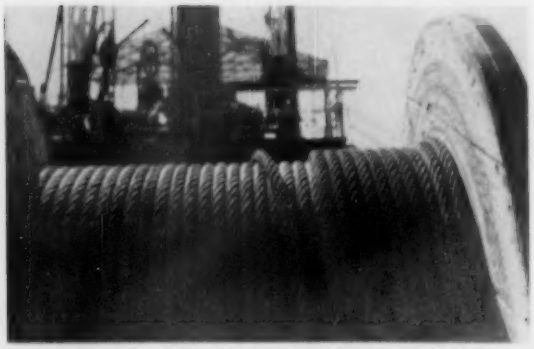
MEASURING LINE DIAMETER the calipers should touch the crest of one strand on either side. New wire rope is slightly larger than nominal diameter.



DRILLING line service (left) is increased by increasing initial length of line. It is decreased by more line in the reeving since much of this line doesn't give maximum work.

OPERATING load (below) affects the service the line will give. The higher the ratio between line strength and working load, the greater the service.





THE LENGTH LINE you need depends on the height of your rig, the load conditions during drilling, and the frequency of moves. Longer lengths give more service.

Make sure line and sheave diameters fit . . .

Bending of the drilling line over sheaves reduces the amount of load it can carry. For the bending itself puts a load on the line. That's why you should be sure that the diameter of the sheaves is big enough for the drilling line you are using.

When a wire rope is used over sheaves that are too small its service life is reduced. Bending causes readjustment of the positions of the wires and strands as well as bending of the wires themselves. Such readjustment which must occur continuously in the multiple-line reeving system causes fatigue. And just as you can break a wire by continuously bending it backward and forward, wires in the drilling line will eventually break.

To minimize the fatigue of the drilling line due to bending, sheave diameters should be within the following limits:

Rope diameter, in.:	Sheave diameter, in. Recommended (6x19)	Sheave diameter, in. Minimum (6x19)
⅞	39	26
1	45	30
1⅛	50	34
1¼	56	38
1⅜	62	41
1½	67	45

Get the line size right . . .

When you replace your line with new rope you should be sure that the new line fits properly. Incorrect measurement of the line might cause you to order a size too small. Not only would this line have insufficient strength and deteriorate fast, but it might cause damage to the sheaves.

The true diameter of wire rope is the diameter of a circle which completely encloses all the rope. Measuring from the crest of one strand to the crest of a strand on the opposite side will give the true diameter. If you put the calipers on the rope where they touch two strands on each side, the diameter you measure will be too small.

How much line?

There is a minimum stringing length of line and there is the length of line that you need to get maximum work from the wire rope. To get maximum work from your drilling line you should provide for slipping and cutting off. This minimizes wear at critical areas.

As the illustration shows, the greater the initial line length the greater the work it will do. Yet, there is a practical limit so that the length is not too unwieldy for field handling. A small rig that makes a lot of moves will have a shorter economical length than a large deep-hole rig.

The following table shows how much line is actually needed for stringing the blocks and suggested lengths that are being found economical in the field. It is assumed that 100 ft. will be on the drum:

Derrick height, ft.:	Lines strung	Minimum length, ft.	Suggested length, ft.
180	6	1,550	3,500
	8	2,000	5,000
	10	2,250	to
	12	2,600	7,500
150	6	1,300	3,500
	8	1,600	5,000
	10	1,900	to
	12	2,200	7,500
125	6	1,100	3,500
	8	1,350	to
	10	1,600	5,000
90	6	800	1,350
	8	1,000	1,550

For any height derrick, the length of line to string the blocks is approximately the height of the derrick multiplied by the total number of lines. This is the number of lines between blocks plus two to account for the fast line and the dead line.

How much line on drum?

An easy way to determine the amount of line for slipping or cutting is to count the wraps on the drum. The length of line for each wrap varies with the diameter of the drum, the diameter of the rope, and the layer that the wrap is in. Here are some rounded-off figures for determining length for the number of wraps. For lines or drums of other sizes interpolate between the figures for the sizes that bracket them.

LENGTH OF LINE PER WRAP, FEET

1-In. Line

Drum dia. (in.)	Layer: First	Second	Third	Fourth	Fifth
12	3.4	3.8	4.1	4.5	4.9
16	4.5	4.8	5.2	5.5	5.9
20	5.5	5.9	6.2	6.6	7.0
24	6.5	6.9	7.3	7.6	8.0

1¼-In. Line

20	5.6	6.0	6.5	7.0	7.4
24	6.6	7.1	7.5	8.0	8.5
28	7.7	8.1	8.6	9.1	9.5
32	8.7	9.2	9.6	10.1	10.6

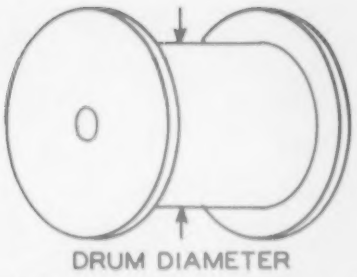
1½-In. Line

28	7.7	8.3	8.8	9.4	9.9
32	8.8	9.3	9.9	10.4	11.0
36	9.8	10.4	10.9	11.5	12.0

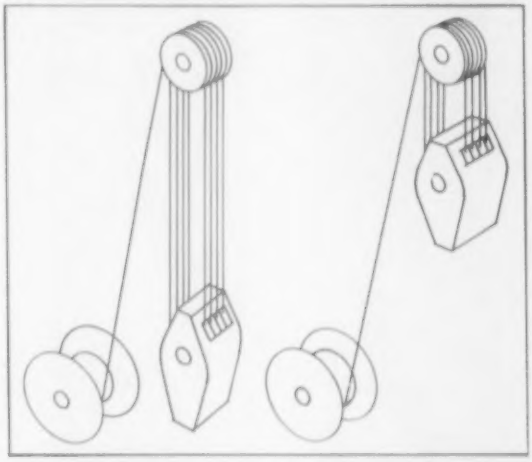
When to slip and cut line?

Despite the care that you give your drilling line to see that it isn't treated badly and harmed through improper practices, the line is going to wear unevenly. Uneven wear may cause failure of only a small part of the line yet the whole line may have to be discarded. Thus, much useful life is lost.

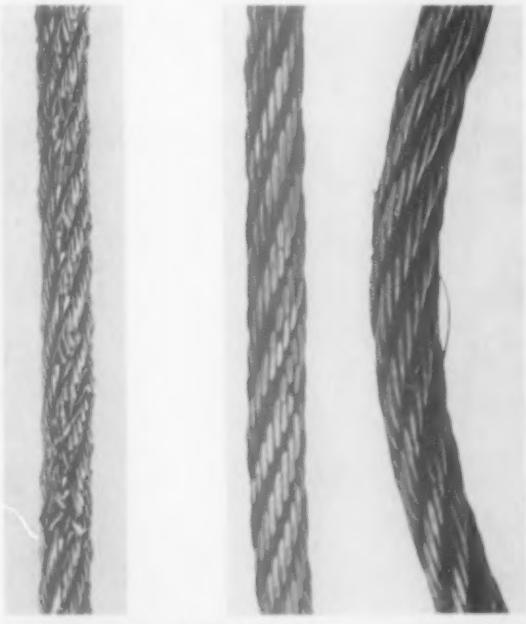
To get more working life out of the drilling line, the wear should be distributed evenly. This can be done by providing an excess of line over that required to string the blocks. As this line is slipped into the reeving system and cut off at the drum end, wear will be distributed over a greater proportion of the line than if the



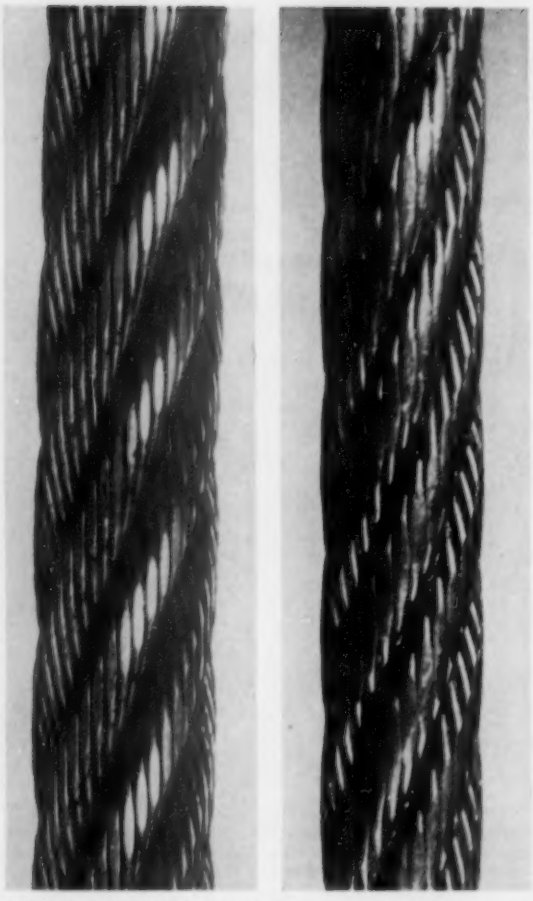
DRUM DIAMETER determines amount of line per wrap. See table for length per wrap for different size lines.



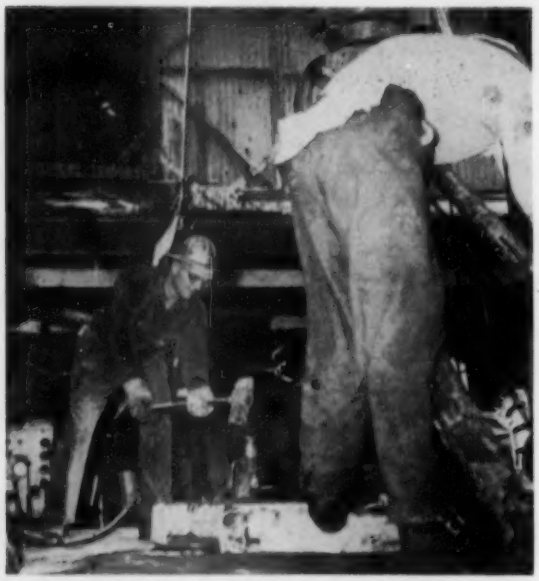
POINTS OF LOAD PICKUP will cause extra wear of line contacting sheaves and drum. Good practice is to slip line through reeving and cut it off at drum so that this wear is spread over its whole length.



SERIOUS WEAR and line failure will occur at drum crossover points, contact points at load pickup and contact at the dead-line sheave unless the drilling line is moved regularly and frequently. Fatigue failure of the line at left is most likely at dead-line sheave and shock points. Wear at right is due to dog leg but is similar to wear at crossover points when line is left in same position too long.



UNIFORM LINE WEAR, left, will occur when a line is properly maintained, moved forward, and cut off. The cutoff program should let it just reach the drum end when it gets to this condition. At right, the line is not worn but the wires have been peened by working around a drum of small diameter.



REGULAR CUTOFFS at even intervals of ton-miles of work will get the most work from a line. Using this type of cutter is much better and safer than using an ax.

line were not moved. The result is more work per foot of total line and less wire-rope expense.

Where wear is bad . . . Generally, with all rotary rigs, there will be three areas on the line where the wear is most severe. These are: (1) Drum wear—this occurs at the points where the line climbs from one layer to the next at the flange and at each point above the first layer where the ongoing wrap has to climb out of the groove and cross over a wrap on the lower layer. (2) Middle of line—this is an area about 600 to 800 ft. from the drum end of the line. This part of the line is wound loosely on the top layer of the drum when the traveling block comes up fast without a load. Usually this is when pipe is being run into the hole. When the heavy load of the full string of drill pipe is picked up, the weight tends to pull the loosely wound rope down between layers of the drum. As the rope pays off, then a severe scrubbing action takes place. (3) Dead-line sheave—this wear is confined to a narrow band of line and yet failure here can cause loss of all the line in the blocks. Wear is usually shown by broken wires. This is because this stationary line absorbs all the vibration of the moving parts and this fatigues and breaks the wires. Many times the broken wires are lying next to the core of the sheave and cannot be seen unless the rope is moved.

Why move? . . . Moving the line or slipping it through the blocks requires little time and when employed between cuts will help equalize wear. In some types of drilling this will allow the line to do more work between cuts. The parts of the line that it helps most are line at the pickup points on the drum, the line on the fast sheaves at the high and low pickup positions, the line that runs both on the drum and through the fast sheaves and part of the line that passes over the dead sheave. Slipping also relieves wear at the dead-line anchor which is caused by the alternate sag and stretch of the line as the drill string bounces during drilling.

Usually, about three to four slips of the line are made for each cutoff. Each slip should move the line toward the drum from 10 to 30 ft. or a length several feet in excess of the distance between the top of the crown-block sheaves and the bottom of the traveling-block sheaves when the traveling block is in the high pickup position. This latter technique insures that the parts of the line do not move from one shock point at the outside of one sheave to the shock point at another sheave. This should be avoided whatever length of line is slipped or cut.

Just because you slip the line, however, don't delay cutting off the drum end. If the slipped line piles up more than one layer deep it will increase the tendency of the working line to wear. The more layers of line spooled the greater is the cutting in and scrubbing.

Figuring work . . . The work done by the line will determine how fast it wears and how often it should be cut. The work is measured in ton-miles and is a function of the weight of drilling string, block, and hook and how often the string is picked up or tripped. Just how much work the line does during ordinary drilling and tripping can be determined from A.P.I. charts or from ton-mile calculators available from most wire-rope companies.

For convenient estimation the following formula may be used: (1) Take the full weight in pounds of

the drill string hanging just off bottom as shown on the weight indicator. (2) Add to this four times the combined weight of the hook and block (see table for estimation). (3) Add to this the buoyed-up weight of the drill collars (see table for correction). (4) Divide the total by 2,000 to get tons. (5) Then take the depth of the hole in feet and divide by 5,280 to get miles. (6) Multiply tons and miles together to get ton-miles per trip.

For the work done during drilling between trips, calculate the ton-miles for two successive trips, subtract them, and multiply the difference by three.

As an example, take the case of a trip from 4,000 ft. with a string of 4½-in. 16.6-lb. per ft. drill pipe and 200 ft. of 5½-in. 67.3-lb. per ft. drill collars. Mud weight is 10.5 lb. per gal. and block, hook, and elevators weigh 10,720 lb. The weight indicator reads 66,500 lb. when the string is hanging off bottom. For the ton-miles per trip A.P.I. charts give 45.5. By the above formula the tons would be: 66,500 + (4 × 10,720) + [200 × (67.3 − 10)]/2,000 = 60.4 tons (drill collar buoyant correction 10 lb. per foot). Miles would be: 4,000/5,280 = 0.758 miles. Work would be: 60.4 × 0.758 or 45.8 ton-miles.

If the next trip were made at 4,200 ft., the work during the trip would be 49.2 ton-miles. Then the work done by the line during drilling between 4,000 and 4,200 ft. would be 3 × (49.2 − 45.8) or 10.2 ton-miles.

When to cut . . . A proper cutoff procedure is one that allows the line to reach the drum just as it becomes worn out. Cuts should be made at regular frequent intervals of ton-miles and cutoff lengths should be nearly the same each time. This makes all parts work equally and, if the work capacity is correctly chosen, will allow more work from the total line. Irregular cutoff lengths and excessive variation in the ton-miles between cutoffs will decrease line service.

Frequent inspection is necessary to establish the work a line can do between cuts. If a line wears excessively before it reaches the cutoff point, it should be removed and the ton-mile schedule adjusted. A good cutoff schedule will move line from between the blocks before it actually becomes worn out. The worn-out part should reach the drum just when the cutoff is to be made.

How much work? . . . Different drilling conditions in different sections of the country affect the calculated ton-miles of work that a length of wire rope can give. For instance, in soft-rock drilling as on the Gulf Coast vibration during drilling is at minimum and rope should give best service. In areas such as the Rocky Mountains or West Texas where drilling is very hard, vibration is a serious factor and reduces the working life of the rope. If digging becomes rough or much fishing is done less actual hoisting work can be done by the line.

BUOYANT CORRECTION FOR WEIGHT OF DRILL COLLARS IN MUD

Collar weight in air, lb. per ft.	50	60	70	80	90	100	110	120
Mud weight (lb. per gal.)	Correction (subtract), lb. per ft.							
10	7.7	9.2	10.7	12.2	13.8	15.3	16.9	18.4
15	11.5	13.8	16.1	18.4	20.7	23.0	25.3	27.6

APPROXIMATE BLOCK AND HOOK WEIGHTS

Capacity, tons	Block, lb.	Hook, lb.	Unitized, lb.
100	3,000	2,000	4,000
200	6,000	4,000	8,000
300	9,000	6,000	12,000
400	13,000	8,000	15,000

Other important factors that determine how much work a reel of wire rope will do are the initial length of the line, the amount reeved, and the design factor under which the rope is working. The accompanying figures show the effect of these factors.

The shorter the initial length, the greater is proportion in between the blocks that doesn't do its full share of work before some part wears out. For a particular length, increasing the amount in the reeving also increases the proportion of rope that isn't fully used. With a long rope and a good cutting practice much more work per foot is obtained.

The safety factor is ratio of the strength of the line to the actual working load. The ton-miles per foot shown is a possible example of what a 1¼-in. rope working with a safety factor of 5 might do. Bigger lines would give more service, smaller lines less. When the safety factor is higher, more work per foot can be done. When it is lower, the work will be less. The working load of different size lines at different safety factors is shown in the section "How Much Can You Pull?"

Amount to cut . . . The accompanying table is a guide to establishing an initial cutoff practice for different size rigs and different areas. This is reproduced, by

DRILLING-LINE SERVICE GOAL

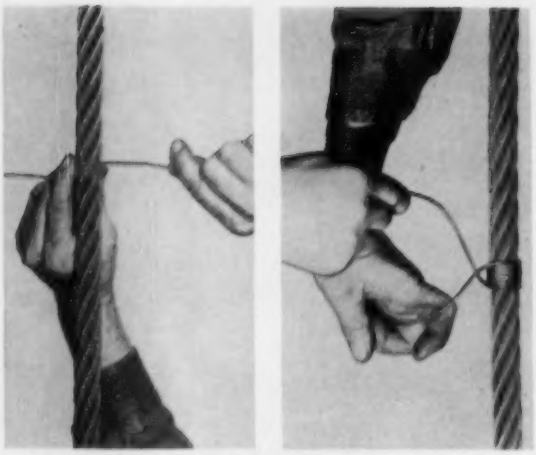
Ton-Miles Before First Cutoff* (Design Factor of 5)

Line size (in.)	Derrick height (ft.)	Rocky Mountain	West Texas, New Mexico	Oklahoma, Kansas	Gulf Coast, California
1	80, 87, 94	500	500	500	600
1⅛	94, 122, 136	600	700	800	900
1¼	122, 136, 140, 147	1,000	1,100	1,200	1,300
1⅜	189	1,600	1,800	2,000	2,100

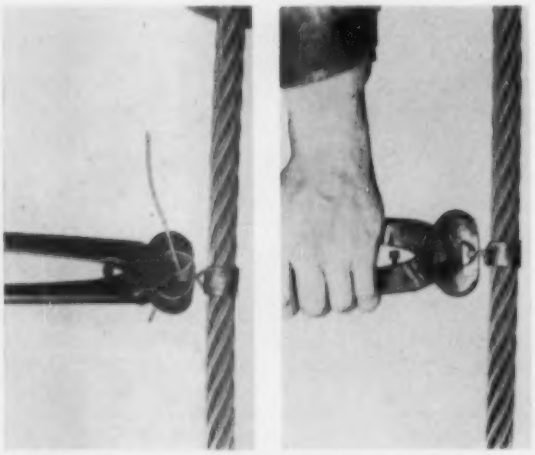
*On succeeding cuts, cut at 100-ton-miles less for 1⅛-in. and smaller and at 200 ton-miles less for 1¼ and 1⅜-in.

Amount to Cut, Number of Drum Wraps Per Cutoff

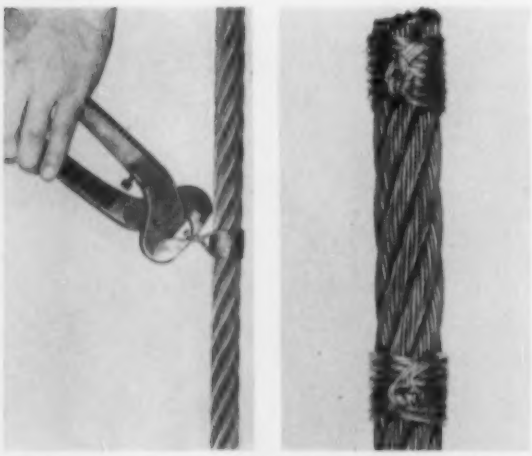
Derrick height (ft.)	Drum diameter (in.) 11	13	14	16	18	20	22	24	26	28	30	32	34	36
187										15½	14½	13½	12½	11½
142 to 147								13½	12½	11½	11½	10½		
133 to 138						15½	14½	12½	11½	11½	10½	9½		
126 to 131				17½	15½	14½	12½	12½	11½	10½	9½	9½		
94 to 100		19½	17½	14½	12½	11½	10½	9½	9½	8½				
87		17½	14½	12½	11½									
66	12½	11½												



PUT SEIZINGS ON LINE before cutting it off to prevent high strands and premature failure. Wind on six to eight turns.



TWIST THE WIRES together by hand and then with cutters. Tighten the seizing by prying twist away from rope with cutters.



TAKE UP SLACK from prying twist and twist again. Repeat operation until seizing is tight and cut off wire ends to finish the seizing.

permission, from A.P.I. R.P. 9B, "Recommended Practices on Application, Care and Use of Wire Rope for Oil-Field Service." After such a practice is set up and used for awhile, the performance and wear of the drilling line will help show how the cutoff procedure may be modified for getting the most wire-rope service.

Notice that even though the smaller rigs require more frequent cutoffs the length cut off is also smaller because of the smaller-diameter drums. Number of wraps shown on the drums will take off from 35 ft. on the smaller rigs to 120 ft. on the largest rigs. (See table in "How Much Does the Drum Hold?" for conversion of wraps to feet.)

Cutting off the line in lengths of uneven wraps is important. This is to avoid letting drum crossover points reoccur in the same portion of line. Cutoff length should also be carefully selected to avoid letting a portion of the rope come in repeated contact with the crown and traveling-block sheaves at pickup points.

How to do it . . . For slipping and cutting you should first suspend the traveling block from the top of the derrick by means of a single line of wire rope. A ready-made line that attaches quickly will save much time. It's extremely important that the fastenings of this suspension line be failproof. Some very serious rig accidents have occurred when the traveling block and hook have come loose and fallen. The hanging position should be about the place where pipe is picked up from the rotary table. Next, for slipping, you should loosen the clamps on the holddown anchor. A good type of holddown anchor will be a sheave which will turn freely as line is pulled through the blocks. To slip the line, merely take up the required number of turns on the drum and tighten the dead-line clamps.

When you are ready to cut off the line you should hang the traveling block in such a position that no more than the number of turns that you plan to cut off is on the drum. Then loosen the dead-line clamps and put the number of turns on the drum that you plan to cut off. Mark this position and unwind the line from the drum by hand for cutting.

Seizing . . . If you are using preformed wire rope you will need two seizings—one on each side of the cut. Nonpreformed rope should have at least two seizings on each side of the cut. The seizing must be tight enough to prevent the strands and wires from unraveling or becoming loose.

First wind the seizing wire tightly around the rope by hand. Wind on about six to eight turns keeping the turns closely together. Twist the ends of the wires together by hand so that the twist is near the middle of the seizing. With special wire cutters, twist the wire further to take up the slack. Don't try to tighten any more by twisting but tighten by prying the twist away from the rope with the cutters. As more slack is gained, take it up by twisting. Repeat until the seizing is tight.

Cutting off . . . There are a number of acceptable ways to cut the line but using an ax is not one. This not only damages the line and the ax but is dangerous to the one who does the chopping.

If you use a hack saw to cut the line, the seizings where the cut is to be made should be just far enough apart to allow the blade to pass. To prevent damage to the wire rope be sure to clamp the rope firmly between wooden blocks to hold the line steady.

When you use a sledge to cut the line, be sure you

don't endanger your eyes. Use a cold cutter rather than the rig builder's hatchet. The head of the hatchet may shatter. It's best to wear goggles in either case. For easier, faster cutting you may want to use a special cable cutter which works by lever or hydraulic action.

How to avoid damage . . .

Your drilling line won't have a chance to give you top service unless you take care of it before you put it to work. Shown here are a number of wrong ways to treat wire rope in handling it and the right ways to handle it.

. . . **In handling the reel,** remember: (1) Don't use a pinch bar on the wire rope itself to roll the reel; pry on the reel flanges. (2) Don't pass a winch line or chain around the wire rope on the reel; use wooden blocks under the lifting chain or put it through the center of the reel. (3) Don't roll the reel over sharp objects that will contact the wire rope; clear the path before you start rolling the reel.

Using the wrong practice here may cause you to cut or nick the wires so that the line is weakened or will fail more quickly when put into fast bending service.

. . . **In handling the line,** remember: (1) Don't reverse the direction of bend when passing the line from reel to sheave or sheave to sheave; always keep the direction of bend the same. (2) Don't drive a nail through the line; tie it with a seizing wire or rope. (3) Don't pull a loop tight; always throw the loop out before it forms a kink. (4) Don't pull line over sills or members of the rig structure; use a snatch block when the path is blocked. (5) Don't put the U-bolt part of a clamp over working line; always put the broad base of the clip on the line under load. (6) Don't let the line become slack between sheaves; always keep it under tension.

Any of these wrong practices may lead to displacement of wires in the rope or complete warping. Weak spots will always develop an unexpected wire breakage or line wear will result.

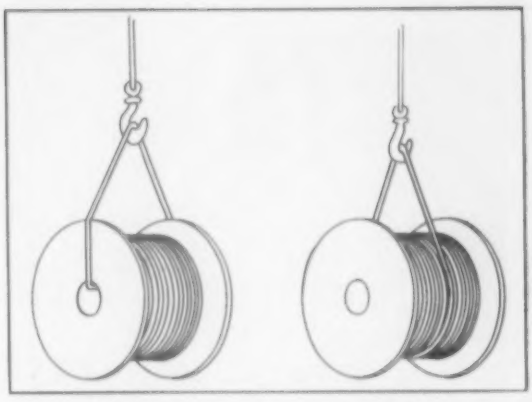
Keep the line lubricated . . .

Just like the parts of a machine, the individual wires of the drilling line are moving continually against each other. These moving parts must be lubricated or they will wear out and fail.

Wire rope is always lubricated when it leaves the factory. Under load, heat, and movement of the line in service, this lubricant may work its way out and be thrown off or lost. Unless it is replaced by additional lubrication in the field some of the life of the rope will be lost. This lubrication should be done often enough to keep the line looking "wet."

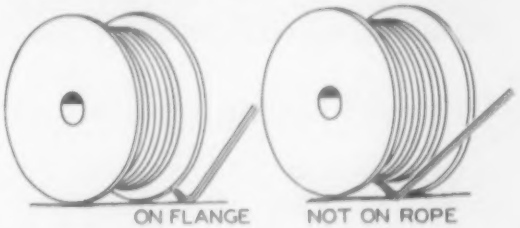
Get it inside . . . Lubricant must penetrate the wire rope to be effective. If it merely cakes on the outside it does not protect the moving parts and it does not prevent moisture from entering. Lubricant will penetrate better when it is hot.

Shown here are a number of methods of applying the wire-rope lubricant. Hot lubricant can best be applied by passing the rope through a heated bath of oil. But perhaps more practical methods are to pour it on or pass it through a vertical reservoir and wipe off the excess. A piece of sheepskin with wool inside makes a good wiper.



RIGHT WRONG

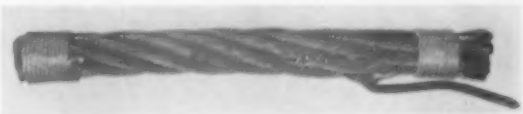
WHEN LIFTING REEL of wire rope never put the hoisting line or chain around the wire rope.



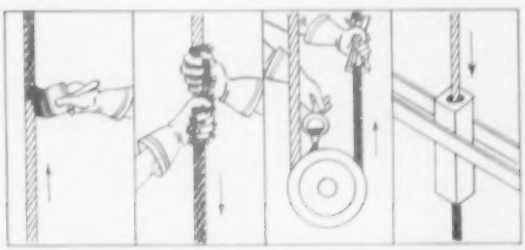
RIGHT WRONG

WHEN ROLLING REEL pry against the reel flange, not the wire rope. Watch out for sharp objects that might cut the rope.

DON'T BEND the drilling line over small sheaves or the rig structure. You may put a dog leg such as this in it and cause this part to wear out prematurely.

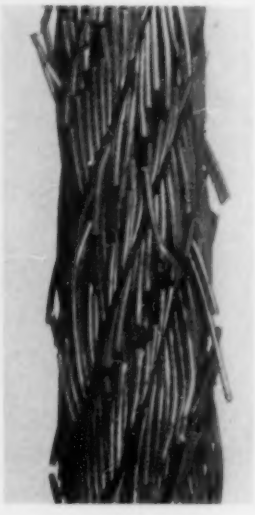


NEVER NAIL THROUGH the wire rope when you anchor the end. Such mistreatment may produce high strands which wear out fast.



LUBRICATE LINE when it starts to look dry. But be sure to use a good lubricant and get it inside the rope.

To avoid having your wire rope end up like this . . .



and to ward off such failures as shown here . . .

Check the symptoms listed below and do something about them

Continuous abrasion: Sheave wrong size; sheave worn; sheave bearing frozen; too large fleet angle; not enough block and hook weight, sheaves misaligned; sheave or drums corrugated; grit and sand in rope.

Wear of single strand: Nailing through line; improper seizing; improper cutting.

Crushed rope: Not enough lines strung; poor spooling; drum too full; sheave grooves too small; line dragged over obstacle; sheave grooves too big.

Extreme local wear: Improper clamping; pulled kink in line; line doglegged by sharp bending.

Scattered broken wires: Reel rolled over sharp object; line dragged on substructure; sheave flange broken; drum groove damaged; line burned by slipping in sheaves.

Strands broken: Overloading; shock loading; reverse bending; sheave or drum diameter too small; wobbling sheaves.

Concentrated wire breakage: Excessive drilling vibration; line whipping; sheaves and drums too small; improper clamping.

Picture Credits

Thanks to the following companies who supplied many of the photographs used in this article: Union Wire Rope Corp.; John A. Roebling's Sons Corp.; Macwhyte Co.; Jones & Laughlin Steel Corp.

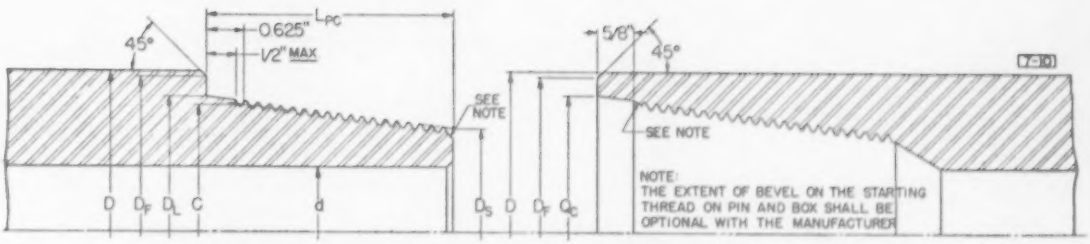
APPENDIX

HOW TO GET YOUR MONEY'S WORTH FROM YOUR DRILL STRING

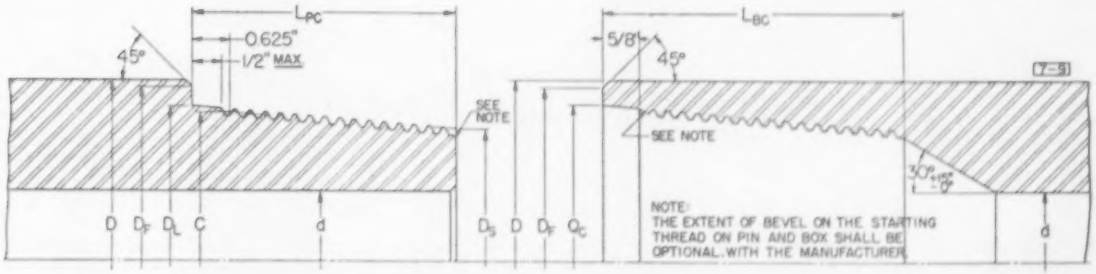
Standards for Designing the Drill String

A.P.I. ROTARY SHOULDERED CONNECTIONS—GENERAL DIMENSIONS
(All dimensions in inches)

(1) Size and style of connection	(2) Outside diameter of connection tol. ±1/32		(3) Bore of pin tol. +1/64 −1/32		(6) Lgth., small end of pin to shoulder tol. +0 −⅛	(7) Depth of box tol. +0 −⅛	(8) Bevel diam. of pin and box shoulder face tol. ±1/64		(10) Counterbore diam. tol. ±1/64
	Std. D	Opt. D	Std. d	Opt. d	L_{PC}	L_{BC}	For std. o.d. D_F	For opt. o.d. D_F	Q_C
Regular Style									
2⅜ REG	3⅛		1		3		3 1/64		2 11/16
2⅞ REG	3¾		1 1/4		3½		3 37/64		3 1/16
3½ REG	4¼	4½	1 1/2		3¾		4 5/64	4 5/64	3 9/16
4½ REG	5½	5¾	2 1/4		4¼		5 19/64	5 19/64	4 11/16
5½ REG	6¾		2 3/4		4¾		6 15/32		5 37/64
6⅝ REG	7¾		3 1/2		5		7 21/64		6 1/16
Full-Hole Style									
3½ FH	4⅜		2 7/16		3¾	4⅜	4 31/64		4 3/64
4 FH	5¼		2 13/16		4½	5⅛	5 1/64		4 11/32
4½ FH	5¾	6	3	3 5/32	4	4⅝	5 17/32	5 17/32	4 7/8
5½ FH	7		4		5	5⅝	6 23/32		5 29/32
6⅝ FH	8		5		5	5⅝	7 45/64		6 27/32
Internal-Flush Style									
2⅜ IF	3⅜		1 3/4		3	3⅝	3 1/4		2 15/16
2⅞ IF	4⅛		2 1/8		3½	4⅛	3 61/64		3 29/64
3½ IF	4¾	5	2 11/16		4	4⅝	4 37/64		4 5/64
4 IF	5¾	6	3 1/4	3 5/16	4½	5⅛	5 17/32	5 17/32	4 29/32
4½ IF	6⅛	6¼	3 3/4		4½	5⅛	5 59/64	5 59/64	5 5/16
5½ IF	7⅜		4 13/16		5		7 9/64		6 29/64



REGULAR STYLE ROTARY SHOULDERED CONNECTION (SEE ABOVE TABLE).



FULL-HOLE AND INTERNAL-FLUSH STYLE ROTARY SHOULDERED CONNECTION (SEE ABOVE TABLE).

A.P.I. STANDARD ROTARY TOOL JOINTS, SCREW-ON TYPE

(All dimensions in inches)

(1) Size and style of tool joint	(2) Outside diameter of connection tol. ±1/32		(4) Bore of pin* tol. +1/64, −1/32		(6) Drill-pipe size and style with which used		(8) Length, face to shoulder, pin member† L_{PS}	(9) Total length tool joint pin tol. +⅛, −½ L_P	(10) Total length tool joint box tol. +⅛, −½ L_B	(11) Combined length pin and box made up tol. +⅜, −1 L	(12) Bevel diam. of pin and box shoulder tol. ± 1/64	
	Standard D	Optional D	Standard d	Optional d	Internal upset	External upset					For std. o.d. D_F	For opt. o.d. D_F
Regular Style												
2⅜ REG	3⅛		1		2⅜		6½	9½	9½	16	3 1/64	
2⅞ REG	3¾		1 1/4		2⅞		6¾	10¼	10¼	17	3 37/64	
3½ REG	4⅛	4½	1 1/2		3½		7⅛	10⅞	10⅞	18	4 5/64	4 5/64
4½ REG	5½	5¾	2 1/4		4½	4	7⅞	12⅛	12⅛	20	5 19/64	5 19/64
5½ REG	6⅝		2 3/4		5½		8⅝	13⅜	13⅜	22	6 15/32	
6⅝ REG	7⅞		3 1/2		6⅝		9½	14½	14½	24	7 21/64	
Full-Hole Style												
3½ FH	4⅜		2 7/16		3½		7⅛	10⅞	10⅞	18	4 31/64	
4 FH	5⅛		2 13/16		4		7¾	12¼	12¼	20	5 1/64	
4½ FH	5¾	6	3	3 5/32	4½	4	7⅞	11⅞	12½	20⅜	5 17/32	5 17/32
5½ FH	7		4		5½		8⅜	13⅜	13⅜	22⅛	6 23/32	
6⅝ FH	8		5		6⅝		9½	14½	14½	24	7 45/64	
Internal-Flush Style												
2⅜ IF	3⅜		1 3/4		2⅜		6½	9½	9½	16	3 1/4	
2⅞ IF	4⅛		2 1/8		2⅞		6¾	10¼	10¼	17	3 61/64	
3½ IF	4⅝	5	2 11/16		3½		7	11	11	18	4 37/64	4 37/64
4 IF	5⅜	6	3 1/4	3 5/16	4½	4	7¾	12¼	12¼	20	5 17/32	5 17/32
4½ IF	6⅛	6¼	3 3/4		5	4½	7⅜	12¼	12¼	20	5 59/64	5 59/64

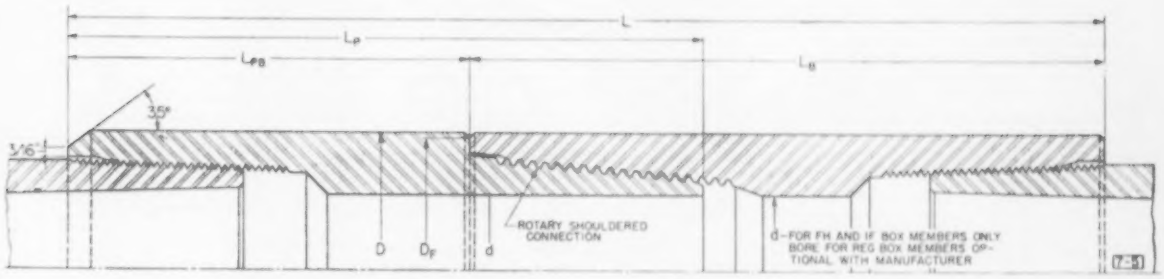
*The bore dimensions (Cols. 4 and 5) apply also to box members of FH and IF tool joints (but not to REG tool joints). †The length and tolerance given for L_{PC} in conjunction with stipulated L_P dimensions and tolerance, govern the length of L_{PS}. The dimensions shown for L_{PS} are nominal, not mandatory.

A.P.I. STANDARD ROTARY TOOL JOINTS, WELD-ON TYPE

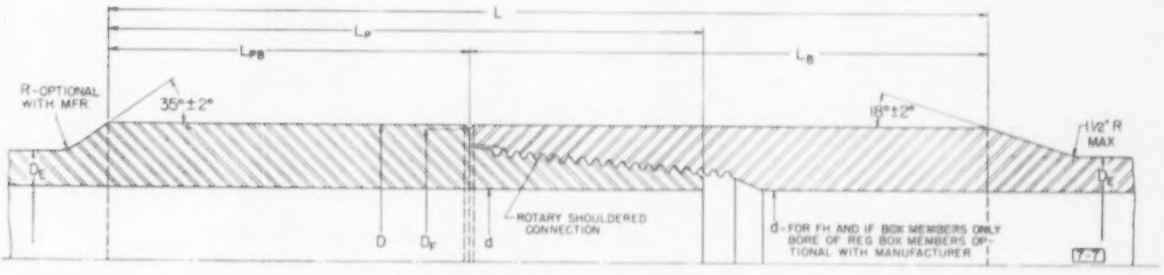
(All dimensions in inches)

(1) Size and style of tool joint	(2) Outside diam. of connection tol. ±1/32 D	(3) Bore of pin* tol. +1/64 −1/32 d	(4) Size and style of drill pipe	(5) Nominal weight of drill pipe,† threads and coupling, lb. per ft.	(6) Length, shoulder to shoulder, pin member‡ L_{PS}	(7) Total length tool joint pin tol. +¼ −⅜ L_P	(8) Length shoulder to shoulder, box member tol. ±¼ L_B	(9) Combined length of box & pin members, made up tol. ±½ L	(10) Diameter of pin and box members at elevator upset max. D_E	(11) Bevel diameter of pin and box shoulder tol. ± 1/64 D_F
Regular Style										
2⅜ REG	3⅜	1 1/4	2⅜ IU	10.40	6	9½	8	14	3	3 37/64
3½ REG	4⅛	1 1/2	3½ IU	13.30	7	10¾	9½	16½	3 11/16	4 5/64
4½ REG	5½	2 1/4	4½ IU	16.60	7	11¼	10	17	4 11/16	4 19/64
4½ REG	5½	2 1/4	4½ EIU	20.00	7	11¼	10	17	4 11/16	4 19/64
5½ REG	6⅝	2 3/4	5½ EIU	21.90	8	12¾	10	18	5 11/16	6 15/32
Full-Hole Style										
3½ FH	4⅜	2 7/16	3½ IU	13.30	7	10¾	9½	16½	3 11/16	4 31/64
3½ FH	4⅜	2 7/16	3½ IU	15.50	7	10¾	9½	16½	3 11/16	4 31/64
4 FH	5¼	2 13/16	4 IU	14.00	7	11½	10	17	4 3/16	5 1/64
4½ FH	5¾	3	4½ IU	16.60	7	11	10	17	4 11/16	5 17/32
4½ FH	5¾	3	4½ EIU	20.00	7	11	10	17	4 11/16	5 17/32
5½ FH	7	4	5½ EIU	21.90	8	13	10	18	5 11/16	6 23/32
Internal-Flush Style										
2⅜ IF	3⅜	1 3/4	2⅜ EU	6.65	6	9	7	13	2 1/2	3 1/4
2⅞ IF	4⅛	2 1/8	2⅞ EU	10.40	6	9½	8	14	3	3 61/64
3½ IF	4¾	2 11/16	3½ EU	13.30	7	11	9½	16½	3 23/32	4 37/64
3½ IF	5	2 11/16	3½ EU	15.50	7	11	9½	16½	3 23/32	4 37/64
4 IF	5¾	3 1/4	4 EU	14.00	7	11½	10	17	4 7/32	5 17/32
4½ IF	6⅛	3 3/4	4½ EU	16.60	7	11½	10	17	4 23/32	5 59/64
§4½ IF	6¼	3 3/4	5 EIU	19.50	7	11½	10	17	5 1/8	5 59/64

*The bore dimensions (Col. 3) apply also to box members of FH and IF tool joints (but not to REG tool joints). †Nominal weights, threads and coupling (Col. 5) are shown for the purpose of identification in ordering. ‡The length and tolerance given for L_{PC} in conjunction with stipulated L_P dimensions and tolerance, govern the length of L_{PS}. The dimensions shown for L_{PS} are nominal, not mandatory. §4½-in. IF joint with 6¼-in. o.d. is used on 5-in. EIU drill pipe to produce an assembly variously known as 5-in. Xtra-Hole and 5-in. Semi-Internal Flush.



ROTARY SCREW-ON TYPE TOOL JOINT



ROTARY WELD-ON TYPE TOOL JOINT

SCREW-ON TOOL JOINTS

(Composite of specifications from several manufacturers. Not standardized by A.P.I.)

Size and style of tool joint	Outside diameter of connection, in. D	Bore of pin, in. d	Drill pipe size and style with which used, in.	Length face to shoulder pin member, in. L_F	Length tool joint box, in. L_B	Combined length pin and box made up, in. L	Bevel diameter of pin and box shoulder, in D_E
			Extra Hole				
3½ E.H.	4¾-4⅞	2 7/16	3½ F.H.	7	11	18	4 35/64
4½ E.H.	5¾-6	3 1/4	4½ F.H.	7¾	12¾	20	5 21/64-5 23/64
5 E.H.	6¼-6¾	3 3/4	5 F.H.	7¾	12¾	20	5 55/64-5 59/64
			Slim Hole				
2⅞	3⅜	1 3/4	2⅞ I.F.				
3½	4	2 1/8	3½ I.F.				
4	4½	2 9/16	4 I.F.				
4½	5	2 11/16	4½ I.F.				

WELD-ON TOOL JOINTS

(Composite of specifications from several manufacturers. Not standardized by A.P.I.)

Size and style of tool joint	Outside diameter of connection D	Bore of pin d	Style and size of drill pipe	Nominal wt. of drill pipe threads, and coupling, lb. per ft.	Length, shoulder to shoulder, pin member L_{PB}	Length, shoulder to shoulder, box member L_B	Combined length of pin and box members made up L	Diam. of pin and box members at elevator upset, max. B_E	Bevel diameter of pin and box shoulder D_E
				Extra Hole					
2⅞	4¼	1 7/8	2⅞ I.F.		6	8	14	3	4 1/32
3½	4¾-4⅞	2 7/16	2⅞ I.F.		7	9½	16½	3⅝	4 17/32
4½	6	3 1/4	4½ I.F.	16.60, 20.00	7	10	17	4⅝	5 23/32
5	6¼	3 3/4	5 F.H.	19.50	7	10	17	5⅛	5 59/64
				Slim Hole					
2⅞	3⅜	1 3/4	2⅞ I.F.	10.40	6	8	14	2⅞-3	3 1/4
3½	4	2 1/8	3½ I.F.	13.30, 15.50	6½	8½	15	3½-3⅝	3 55/64
4	4½	2 9/16	4 I.F.		6½	9½	16	4-4⅛	4 11/32
4½	5	2 11/16	4½ I.F.	16.60, 20.00	6½	9½	16	4½-4⅝	4 49/64

A.P.I. DRILL-PIPE LIST*

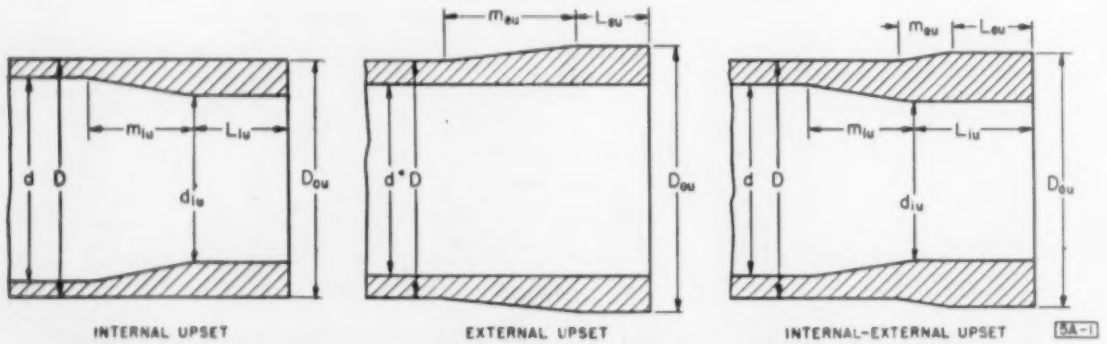
(1) Size, in. o.d. D	(2) Nominal wt., threads and coupling, lb. per ft.	(3) Grade	(4) Wall thickness, in., t	(5) Threaded ends, for use with tool joints having drill-pipe threads	(6) Upset ends, for attachment to rotary connections by welding
2⅜	4.85	E	0.190	Internal or external upset	
2⅜	6.65	D, E	0.280	Internal or external upset	External upset
2⅜	6.85	E	0.217	Internal or external upset	
2⅜	10.40	D, E	0.362	Internal or external upset	Internal or external upset
3½	9.50	E	0.254	Internal or external upset	
3½	13.30	D, E	0.368	Internal or external upset	Internal or external upset
3½	15.50	D, E	0.449	Internal or external upset	Internal or external upset
4	11.85	E	0.262	Internal or external upset	
4	14.00	D, E	0.330	Internal or external upset	Internal or external upset
4½	13.75	E	0.271	Internal or external upset	
4½	16.60	D, E	0.337	Internal or external upset	Internal or external upset
4½	20.00	D, E	0.430	Internal or external upset	External upset or internal-external upset
5	19.50	D, E	0.362	Internal upset	Internal-external upset
5½	19.20	E	0.304	Internal upset	
5½	21.90	D, E	0.361	Internal upset	Internal-external upset
5½	24.70	D, E	0.415	Internal upset	
6⅝	25.20	D, E	0.330	Internal upset	

*Drill pipe with special end finish is available under this specification.

A.P.I. THREADED EXTERNAL-UPSET DRILL-PIPE DIMENSIONS AND WEIGHTS

(1) Size: Outside diameter, in. D	(2) Nominal weight,* threads and coupling, lb. per ft.	(3) Wall thickness, in. t	(4) Inside diameter, in. d	(5) Calculated weight, lb. per ft. Plain end w_{pe}	(6) Upset: Threads only* w	(7) Upset: Threads and coupling* w	(8) Calculated coupling weight, lb.	(9) Upset: Outside diameter in. D_u	(10) Upset: Total length, in. Max. L_{eu}	(11) Upset: Total length, in. Min. L_{eu}	(12) Length of taper min., in. m_{eu}
2⅜†	4.85	0.190	1.995	4.43	4.59	4.83	5.97	2.656	5⅛	4⅛	2½
2⅜	6.65	0.280	1.815	6.26	6.43	6.64	5.97	2.656	5⅛	4⅛	2½
2⅜†	6.85	0.217	2.441	6.16	6.41	6.86	10.78	3.219	5⅝	4⅝	2½
2⅜	10.40	0.362	2.151	9.72	9.97	10.35	10.78	3.219	5⅝	4⅝	2½
3½†	9.50	0.254	2.992	8.81	9.09	9.51	11.17	3.824	5⅝	4⅝	2½
3½	13.30	0.368	2.764	12.31	12.60	12.96	11.17	3.824	5⅝	4⅝	2½
3½	15.50	0.449	2.602	14.63	14.91	15.24	11.17	3.824	5⅝	4⅝	2½
4†	11.85	0.262	3.476	10.46	11.04	11.85	20.27	4.500	6⅜	5⅜	2½
4	14.00	0.330	3.340	12.93	13.52	14.28	20.27	4.500	6⅜	5⅜	2½
4½†	13.75	0.271	3.958	12.24	12.89	13.77	22.34	5.000	6⅜	5⅜	2½
4½	16.60	0.337	3.826	14.98	15.63	16.46	22.34	5.000	6⅜	5⅜	2½
4½	20.00	0.430	3.640	18.69	19.34	20.10	22.34	5.000	6⅜	5⅜	2½

*Nominal weights, threads and couplings (Col. 2), are shown for the purpose of identification in ordering. Calculated weights (Cols. 6 and 7), are based on 20-ft. lengths. †Drill pipe of the least weight in each size is tentative and applicable to Grade E only.



UPSET DRILL PIPE FOR ATTACHMENT OF ROTARY CONNECTIONS BY WELDING (SEE OPPOSITE PAGE).

A.P.I. THREADED INTERNAL-UPSET DRILL-PIPE DIMENSIONS AND WEIGHTS

(1) Size: Outside diameter, in. D	(2) Nominal weight,* threads and coupling, lb. per ft.	(3) Wall thickness, in. t	(4) Inside diameter, in. d	(5) Calculated weight, lb. per ft. Plain end w_{pe}	(6) Upset: Threads only* w	(7) Upset: Threads and coupling* w	(8) Calculated coupling weight, lb.	(9) Upset: Inside diameter at end of pipe, in. d_{ue}	(10) Upset: Inside diameter full upset, in. d_{iu}	(11) Upset: Total length, min., in. L_{iu}	(12) Upset: Length of taper, min., in. m_{iu}
2⅜‡	4.85	0.190	1.995	4.43	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)
2⅜	6.65	0.280	1.815	6.26	6.41	6.60	5.64	1 3/8	1 1/8	3¼	1½
2⅞‡	6.85	0.217	2.441	6.16	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)
2⅞	10.40	0.362	2.151	9.72	9.94	10.27	9.41	1 9/16	1 3/16	3½	1½
3½‡	9.50	0.254	2.992	8.81	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)
3½	13.30	0.368	2.764	12.31	12.58	12.87	9.67	2 3/8	1 7/8	3½	1½
3½	15.50	0.449	2.602	14.63	14.86	15.12	9.67	2 1/4	1 3/4	3½	1½
4‡	11.85	0.262	3.476	10.46	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)
4	14.00	0.330	3.340	12.93	13.49	14.08	16.32	2 5/8	2 3/8	4½	2
4½‡	13.75	0.271	3.958	12.24	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)
4½	16.60	0.337	3.826	14.98	15.73	16.46	20.27	3 1/32	2 13/16	5	2
4½	20.00	0.430	3.640	18.69	19.25	19.90	20.27	3 1/32	2 13/16	5	2
5	19.50	0.362	4.276	17.93	18.30	19.07	22.34	4 1/16	3 11/16	5	2
5½‡	19.20	0.304	4.892	16.87	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)	(‡)
5½†	21.90	0.361	4.778	19.81	20.73	21.88	31.10	4 5/32	3 13/16	5	2
5½†	24.70	0.415	4.670	22.54	23.62	24.73	31.10	3 7/8	3 1/32	5	2
6⅝	25.20	0.330	5.965	22.19	23.24	24.62	37.00	5 11/32	5	5	2

*Nominal weights, threads, and couplings (Col. 2), are shown for the purpose of identification in ordering. Calculated weights (Cols. 6 and 7), are based on 20-ft. lengths.

†All sizes of internal-upset drill pipe are uniform in outside diameter except 5½-in. which has a small external upset at the ends, conforming to the following dimensions: Outside diameter of upset, D_u = 5.563 in. Minimum (total) length of upset, L_{iu} = 4 ⅜ in. Minimum length of taper, m_{iu} = 1 in.

‡Drill pipe of the least weight in each size (except 5 and 6⅝-in.) is tentative and applicable to Grade E only. For these weights, the dimensions of the internal upsets and the calculated weights, shall be as agreed upon between the purchaser and the manufacturer.

A.P.I. UPSET DRILL PIPE FOR ATTACHMENT OF ROTARY CONNECTIONS BY WELDING

(1) Pipe size: Outside diameter, in. D	(2) Nominal weight,* threads and coupling, lb. per ft.	(3) Wall thickness, in. t	(4) Inside diameter, in. d	(5) Calculated weight upset,* lb. per ft. w	(6) Upset: Outside diameter, in. +⅛, —1/32 D_{iu}	(7) Upset: Inside diameter, full upset, in. ±1/16 d_{iu}	(8) Upset: Length of internal upset, in. +1½, —½ L_{iu}	(9) Upset: Length of internal taper, in., min. m_{iu}	(10) Upset: Length of external upset, in. ±½ L_{eu}	(11) Upset: Length of external taper, in., min. m_{eu}
Internal-Upset Drill Pipe										
2⅞	10.40	0.362	2.151	9.88	†2.875	‡1 5/16	1¾	1½		
3½	13.30	0.368	2.764	12.53	†3.500	‡1 15/16	1¾	1½		
3½	15.50	0.449	2.602	14.80	†3.500	‡1 15/16	1¾	1½		
4	14.00	0.330	3.340	13.16	†4.000	‡2 3/4	1¾	2		
4½	16.60	0.337	3.826	15.27	†4.500	‡3 5/32	1¾	2		
External-Upset Drill Pipe										
2⅜	6.65	0.280	1.815	6.35	2.656				1⅜	2½
2⅞	10.40	0.362	2.151	9.84	3.219				1⅜	2½
3½	13.30	0.368	2.764	12.45	3.824				1⅜	2½
3½	15.50	0.449	2.602	14.77	3.824				1⅜	2½
4	14.00	0.330	3.340	13.18	4.500				1⅜	2½
4½	16.60	0.337	3.826	15.26	5.000				1⅜	2½
4½	20.00	0.430	3.640	18.97	5.000				1⅜	2½
External-Internal-Upset Drill Pipe										
4½	20.00	0.430	3.640	19.12	4.781	‡3	2¼	2	1½	1
5	19.50	0.362	4.276	18.36	5.188	‡3 11/16	2¼	2	1½	1
5½	21.90	0.361	4.778	20.34	5.563	‡4	2¼	2	1½	1

Note: Drill pipe having ends as dimensioned in above table is intended for use in making composite pipe with welded-on rotary drilling connections.

*Nominal weights, threads, and coupling (Col. 2), are shown for purpose of identification in ordering. Calculated weights (Col. 5), are based on 20-ft. lengths.

†The ends of internal-upset drill pipe shall not be smaller in outside diameter than the values shown in Col. 6. They may be furnished with slight external upset, within the tolerance specified.

‡Maximum taper on inside diameter of internal upset, ¼ in. per foot on diameter.

OFFICE MEMORANDUM

To: Rig Personnel Date: December 12, 1955

From: R. J. Brownell

Subject: Employee Classifications

In an effort to provide near continuous employment for our personnel, we submit the following proposal for your opinion.

It is our intention to classify our motormen, derrickmen, and drillers into three grades each. As a motorman demonstrates his ability and meets certain standards, he will be given a rating which entitles him to more pay. This same system will apply to derrickmen and drillers. We intend to offer more take-home pay to those who are doing a better job.

Special training schools will be set up to train those who are qualified for advancement. Men will be paid while attending school. The number of men at one time that are so trained will be limited, thus making it a slow process in changing over to the merit system.

Promotions will be made on the basis of a man's knowledge of his job. Men with seniority will be given priority when other qualifications are equal. A board will meet each quarter and evaluate all men seeking advancement. This board will include the manager of drilling operations, drilling superintendent, division drilling superintendent, and safety director. A complete set of records on each man will be kept to insure the qualified man a chance to get ahead. Under our present system we feel that some well qualified men have been bypassed.

Under the proposed program men with superior ratings will be given priority in employment, thus providing more regular employment for more of our reliable men. Layoffs and down time for these men will be minimized.

This program is just in the planning stage. Your opinion is necessary to determine if such a program will be worthwhile to you and our company.

Ask your pusher or safety engineer for more detailed information if needed.

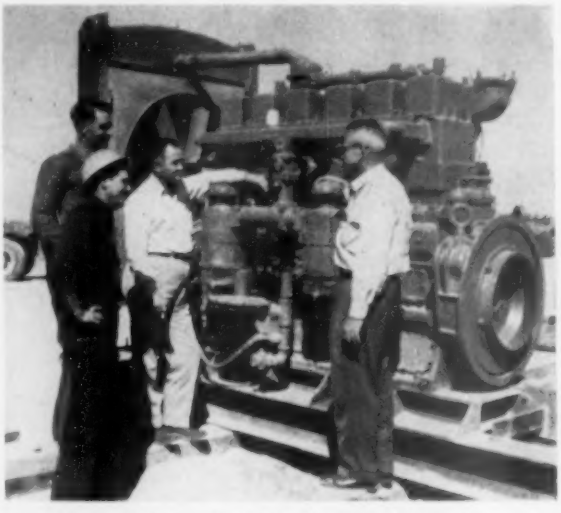
Do you favor the program?_____
(Yes or No)

Express your opinion in the following space and include any suggestions we might be able to use. Return this form to your supervisor (Use back of this sheet).

R. J. Brownell

R. J. Brownell

These men voted for a training and merit raise system.



Now they are being taught in the classroom, above, and field, below, how to become more valuable, better-paid employes.

An idea is born, is voted upon, and enthusiastically endorsed. Results are

Lower Turnover, Better Upkeep, Faster Drilling

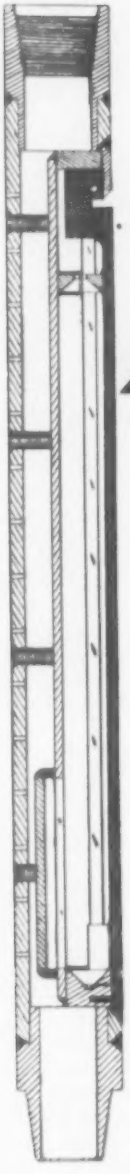
Drilling contractors always have had a high turnover in personnel. But, now, the situation is becoming a real headache; almost all contractors report trouble in getting and keeping good men. Most try to hold their crews by simply "being good to the boys" and they do nothing to upgrade the men. Apparently, such a vague approach is not enough. But here's one company who is doing something concrete about the training and turnover of its personnel. Great Western Drilling Co. is putting its men through a training school and following it up with pay-raise and other incentives to remain on the job. The company expects that the program will not only upgrade the crews but also make a big cut in turnover. Such a program would be a wise investment for other contractors.

DRILLING . . . *METHODS*

by Ed McGhee
District Editor

RECENTLY, Great Western Drilling Co., of Midland, Tex., set about finding ways to attract good men to its crews and to keep them there. At the same time, this contracting company was interested in upgrading its personnel. Company officials were certain that trained crews with a low turnover would pay off in better maintenance, faster over-all drilling time, and improved safety. They realized that good equipment is not enough. The key to successful contracting is the quality of the service given the customer, and quality personnel are a good guarantee for quality service.

The solution hit upon by Great Western is unique in the drilling industry. This company is conducting its own school for rig personnel. But, equally



quickly!
through this side door...

COMES HALLIBURTON'S

BOURDON TUBE PRESSURE RECORDER

TESTING DATA NOW AVAILABLE FAST AS STRING IS SURFACED!

No longer is it necessary to wait for joints to be broken to get the vital information that tells the story of a new well. Halliburton's new B.T. Running Case has a side door that can be opened as soon as it is surfaced, giving quick access to the Bourdon Tube Pressure Recorder. You get the information you're anxious to have 30 minutes to an hour sooner. Work on the string can continue while pressure curve is analyzed. *Another Halliburton first!*

ADAPTABLE ANYWHERE BELOW PACKER

Another advantage of the Side Door Blanked Off B.T. Running Case is that the Bourdon Tube Pressure Recorder can be blanked off without blanking off the anchor below. The blanked off feature allows detection of formation pressure even if perforations are plugged.

BUILT FOR HEAVY DUTY

Like all Halliburton equipment, this new tool is built for rugged service under the most severe conditions. The hinged side door is quickly and easily opened by removing one stud.

Now you can get the greater accuracy of Halliburton's "BT" Pressure Recording Device and dual C.I.P. testing technique, PLUS quicker access to the data. Another reason why Halliburton's best for your drill stem test! Your Halliburton testing representative has all the data. Call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

COMPLETE DATA SENT ON REQUEST

Add this valuable information to your Halliburton Service File

HALLIBURTON TESTING SERVICE

251 SERVICE CENTERS — JUST MINUTES AWAY FROM ANY RIG

as important, the company follows up the training with incentives in the form of better pay, chances for better jobs, and continuity of employment.

The fourth class of the company's men are now in the Rig Personnel School. Their pay goes on during the 5-week course although they do very little productive work. Nevertheless, Great Western expects to continue the school as long as there are enough non-graduates left among its employes.

Double-barrel system . . . Half of the aim of Great Western's new program—training—is the function of its school. Table 1 is the present curriculum. Notice that this curriculum mostly teaches practical information that the men can put to work immediately on returning to their rigs. However, some time also is devoted to the theory of drilling practice and to safety.

Men sent to the school are carefully screened beforehand on the basis of mechanical-aptitude tests, safety records, length of service, and written recommendation of their immediate supervisor.

The school is continuous except for a 1-month break for the instructors' vacations. The men are brought to the company's Odessa yard for the school and attend classes 6 days per week. They are paid accordingly. Two weeks of the course, the men actually make rounds and overhaul engines with the maintenance mechanics.

The other half of the program's aim—cutting turnover—is embodied into a merit-rating system for the rig jobs. Each job will have three grades according to the man's knowledge of his job. Thus, a man may start out as Motorman C, then be raised to Motorman B as he improves, and finally become Motorman A when he is really first rate. The same grades will be set up for derrickman and driller jobs. In order to qualify for these job ratings, a man must have completed the Rig Personnel School course.

The fruits of this merit-rating system, Great Western believes, will offer the men real incentives to remain on the job. These incentives will be:

. . . Pay raises. Each successively higher rating will bring a pay raise.

. . . Chances for promotion. As the merit system grows, it will be used to screen men for promotion. Drillers will be picked from motormen or derrickmen with A ratings. Men will have the chance to hold dual ratings as both derrickmen and motormen, thus giving a wider scope to the training. Tool pushers will be picked, as fast as possible, from drillers with A rating.

. . . Security against layoff. Men with good ratings will be kept on the payroll, if possible, when their rigs are stacked and some crew members must be laid off.

. . . Pride in the job. The natural competitive spirit will encourage the men to do their best and earn higher ratings. The school and merit rating will give them a sense of identification with the company.

How to get a rating . . . After a man has graduated from Great Western's school, he still has no rating and his pay is the same as before. However, 90 days after he leaves the school, his record comes up for automatic review. If he has absorbed the lessons taught at school and if his driller and tool pusher are satisfied with his progress, he is rated Motorman C. And he gets a pay raise.

Periodically after that, the man's record is again reviewed. When he's ready for it, he's promoted to Motorman B and finally to Motorman A. Each raise in rate brings a raise in pay.

Curriculum for Rig-Personnel School

FIRST WEEK

First Day—Morning Session

An outline of company organization:
1. Purposes of program.
2. Explanation of employes' benefits derived from this program.

First Day—Afternoon Session

Lubrication:
1. Basic lubrication to cover lubricating oils, greases and testing procedures, and oil coolers.
2. Use of A.S.T.M. testing devices will be made to illustrate properties of different lubricants.

Berry hydraulic system:
1. Principles of operation.
2. Care and maintenance.

Second Day—Morning Session

Cooling systems:
1. Water filters.
2. Include testing of water, explanation of water hardness and effects on radiator cooler.
3. Pressure caps, explanation of water filter, cutaways of filters, cutaway of radiator cores.
4. Diagram of back pressure against cooling fans—radiator covers. Thermostats and thermostat bypasses—oil coolers.

Second Day—Afternoon Session

Fuels:
1. Basic theory on energy and heat. Specification for fuels and proper handling of fuels from storage to fuel pump and regulators. Including measurement and gaging of fuel deliveries.

Hydromatic system:
1. Principles of operation.
2. Care and maintenance.

Third Day—Morning Session

Function of engine equipment:
1. Theoretical, followed by disassembly of actual piece of equipment.

Third Day—Afternoon Session

Practical application of engine equipment:
1. Running of engines, carburetor settings, etc.

Fourth Day—Morning Session

Fuel system on diesel equipment.

Fourth Day—Afternoon Session

Practice on diesel equipment.

Fifth Day—Morning Session

Duties and responsibilities of the motorman:
1. Proper means of preparing forms.
2. Importance of forms and how they are used by office personnel and maintenance department.
3. Review of personnel benefits and personnel forms.
4. Proper radio procedure.

Fifth Day—Afternoon Session

Maintenance and care of light plants:
1. Electric wiring, electric motors, switches, meters.

Sixth Day—Morning Session

General review of week.

Sixth Day—Afternoon Session

General practice review.

SECOND WEEK

First Day—Morning Session

Theoretical operation of diesel and gas engines—maintenance department (practical demonstrations during day).

First Day—Afternoon Session

Nomenclature of clutch parts and air equipment of engines.

Second Day—Morning Session

Uses of air-operated equipment—maintenance department (using cutaways for explanation).

Second Day—Afternoon Session

Draw works:
1. How to check for worn sprockets and chains.
2. Oil system.
3. Adjustment of mechanical clutches.

Third Day

Field trip for air-operated equipment (specifically for air equipment and anything else covered to date).

Fourth Day

Torque converters—fluid couplings (trip to supply company to observe stripped-down torque converters).

Fifth Day

Auxiliary equipment:
Mud pumps, centrifugal pumps, rotary tables, swivels, crowns, their uses.

Sixth Day

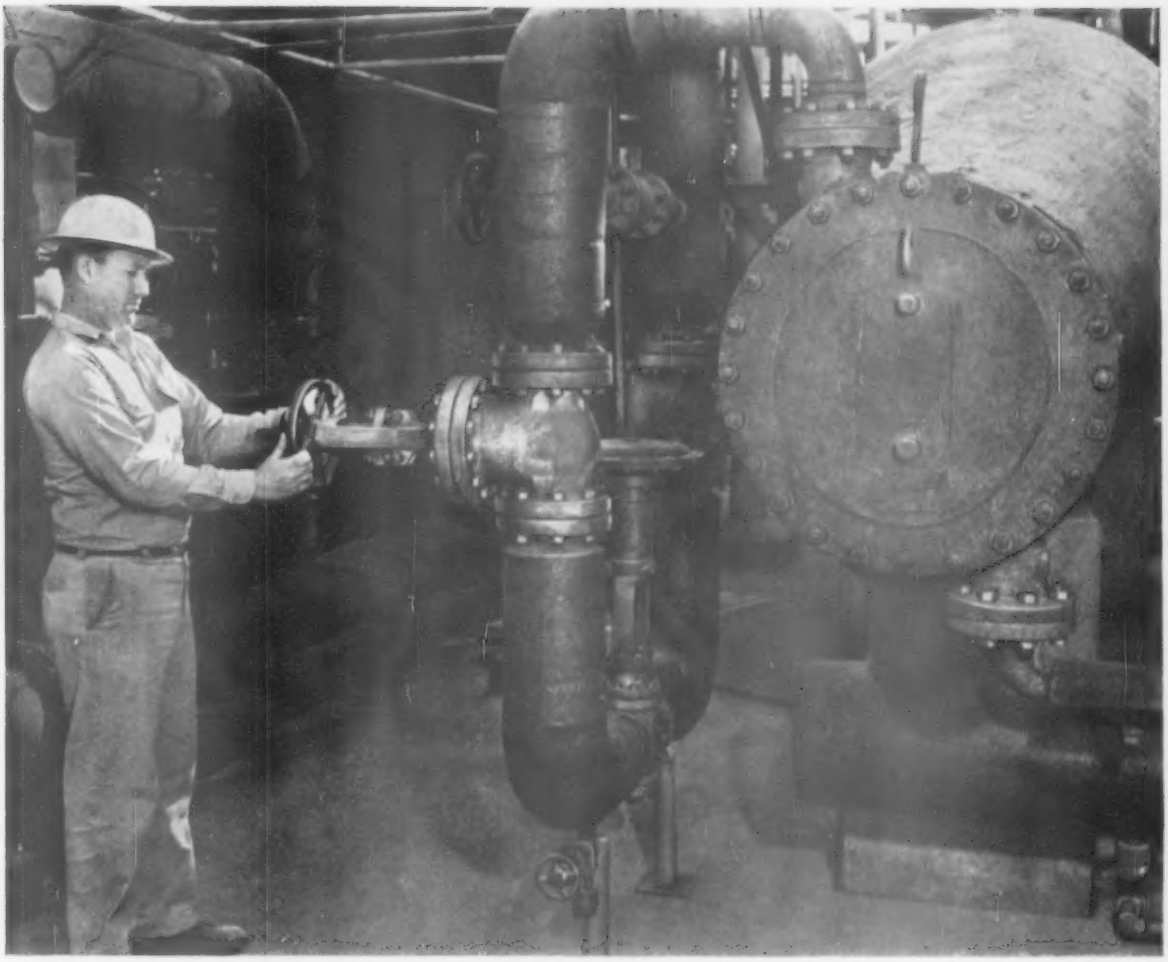
Review of previous week—oral—maintenance department.

THIRD AND FOURTH WEEKS

Trainees will work under the supervision of the maintenance department and will be assigned to the jobs which will benefit them most. This will include shop work as well as field work with the mechanics.

FIFTH WEEK

Films and lectures on care of drill pipe.
Films and lectures on care of casing.
Films and lectures on care of wire rope.
Lessons on mud, drilling practices, and safety.



This Crane valve joins the "12-year service club" on steam

Valve performance like this looks good on any plant's cost sheets.

In 1944, Eastern States Petroleum Company installed this Crane 4-inch 33XR steel gate valve in its Houston refinery, handling 150 pounds of steam at 375° F. It's a busy valve—operation is frequent.

Despite the fact that this Crane valve has an even dozen years of severe service—with opening and closure at close intervals—*no* maintenance or service has been required except repacking.

Before you lift an eyebrow in surprise, consider the fact that Crane valves have performance records like this throughout industry, on all types of flow control. There's a logical reason, of course: Crane valves are strictly quality *all* the way—from research and engineering through precision manufacturing, assembly and testing methods.

Any wonder why men who know valves say *Crane is the name to depend on?* Don't gamble with your all-important flow control—specify Crane valves and fittings from the world's largest line, built with a century of matchless experience. Get the facts from your local Crane Representative, or write to the address below.

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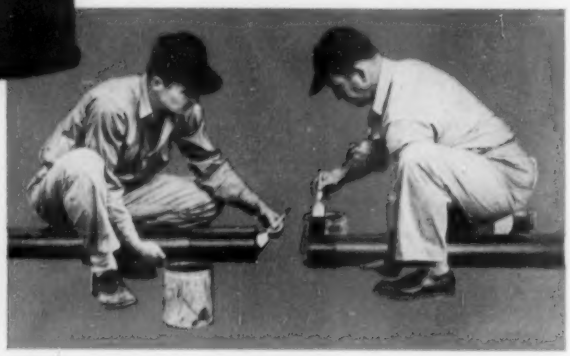

TO JOIN TENITE BUTYRATE PIPE

JOINING pipe made of Tenite Butyrate plastic is fast and easy in the field. In fact, the only "tool" needed is a paint brush. Solvent cement is brushed on the exterior of the pipe ends and on the interior of the Tenite slip-sleeve coupling. The pipe ends are slipped into the coupling, and the job is done! Using this method, three unskilled men can lay 4,000 feet of 4" Tenite plastic pipe in one day.

This is only one advantage of Tenite Butyrate plastic pipe. It weighs only one-sixth as much as metal pipe and often provides as much as 40% greater flow volume for any given head loss. It can be cut with a hand saw. In service, it remains free of corrosion and resists paraffin accumulation. Result: a pipe line that is installed easily and furnishes years of efficient, trouble-free service.

For the names of companies that produce pipe and a complete range of fittings made of Tenite Butyrate, as well as for additional information about this Eastman plastic, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
BUTYRATE
an Eastman plastic

A 16-mm. sound-color film, "PLASTIC PIPELINES," is available upon request.

The same steps apply for derrickmen and drillers. Great Western officials say that a lot will be required of a man who becomes a Driller A. He will have to be the best.

To make the job-rate changes, there is a review board that meets quarterly. The members of that board are the operating vice president, the drilling superintendent, the chief engineer, and the safety director. They inspect the qualifications of each man up for a raise in grade. They grant raises to those qualified. Shown is the form that is submitted for each man by his driller or tool pusher. This report is used by the review board to help judge a man's readiness for a grade raise.

Personnel Rating Sheet

Name

Rated by

Classification

Division

Phase of training

1. Enthusiasm:
   (a) Eager to learn all phases
   (b) Enthusiastic about certain things
   (c) Does work satisfactorily, no apparent enthusiasm
   (d) Holds back

2. Personality:
   (a) Is liked by everyone
   (b) Well liked
   (c) Neither well liked nor disliked
   (d) Liked by some—disliked by others
   (e) Refuses to mix

3. Ability to learn:
   (a) Grasps ideas and methods quickly
   (b) Satisfactory ability to grasp ideas and methods
   (c) Requires detailed instructions
   (d) Needs repeated instructions

4. Emotional balance:
   (a) Always calm
   (b) Has good self-control
   (c) Easily excited
   (d) Moody at times
   (e) Nervous and irritable

5. Industry:
   (a) Always finds something to do
   (b) Generally busy
   (c) Only does what is required
   (d) Requires urging

6. Ability to accept correction and criticism:
   (a) Appreciates correction, careful not to repeat mistakes
   (b) Accepts correction readily, tries to improve
   (c) Accepts criticism, does very little to improve
   (d) Resents criticism

7. Cooperation:
   (a) Goes out of way to cooperate
   (b) Good team worker
   (c) Meets others halfway
   (d) Difficult to work with
   (e) Constant friction with others

8. Physical condition:
   (a) Works without exhaustion
   (b) Strength adequate for job
   (c) Easily exhausted
   (d) Lacks energy

Type rig

Number of hours in operation of draw works

Although the men do little productive work while in school, their pay goes on. Great Western regards this money as an investment that will be paid off in better crews.

How it started . . . When the idea of a training school and grade-rating system was first advanced, there was some reluctance just as there is with any drastically new idea. For that reason, the management asked all area drilling superintendents and tool pushers to think over the plan and list any objections that might arise to it.

When this was done, the management studied the possible objections to find ways to overcome them. Then, with all known trouble spots covered as well as possible, Great Western took the plan to the crews themselves.

The men were told about merit rating and about the plans for a school. They were told that those in school would be paid for the time. They were told that promotions would be on the basis of ability, but that seniority would count when other qualifications were equal.

Then, the crews voted in secret ballot. Almost to a man, they voted in favor of working under the new plan. Shortly after, the first group of men entered the newly instituted Rig Personnel School.

Benefits company too . . . Great Western's new system should begin to pay off immediately in at least two ways. First, the school training should bring a marked improvement in equipment maintenance. In the past, poor maintenance has not always been the result of carelessness, but of simply not knowing what is required. The school will help that situation.

Next, the merit rating system will automatically classify the men to form a nucleus of highly trained, capable men. These could be retained on the payroll in the event of a widespread slowdown in drilling activity. Then, when activity again picks up, this group of men would be a firm core on which to rebuild the crews.

It will make it easier to maintain higher standards of performance through better understanding of company policies and practices. Better understanding means better cooperation, which in turn means better service, a goal all contractors would like to achieve.

"Great Western's new system should begin to pay off immediately . . . in improved equipment maintenance and in forming a nucleus of highly trained, capable men."

Youngstown's "big 5"

HELP MAKE ANY OIL OR GAS LINE INSTALLATION EASIER, QUICKER, LOWER IN COST

Here are the "Big 5" reasons why Youngstown Electric Weld Line Pipe is your best buy:

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2. Wall thickness is uniform
3. Line up characteristics are excellent
4. Weldability is outstanding
5. Long lengths save you time and trouble

Why does the welder like to work with Youngstown Electric Weld Line Pipe? The answer is apparent! Youngstown Electric Weld Line Pipe is designed for easy welding. The same physical and chemical characteristics that make for perfection in welding at the mill also contribute to efficient, dependable welding in the field. Freedom from delays in welding, speed up installation of the pipe line—reduces contractors' costs.

Youngstown
ELECTRIC WELD LINE PIPE

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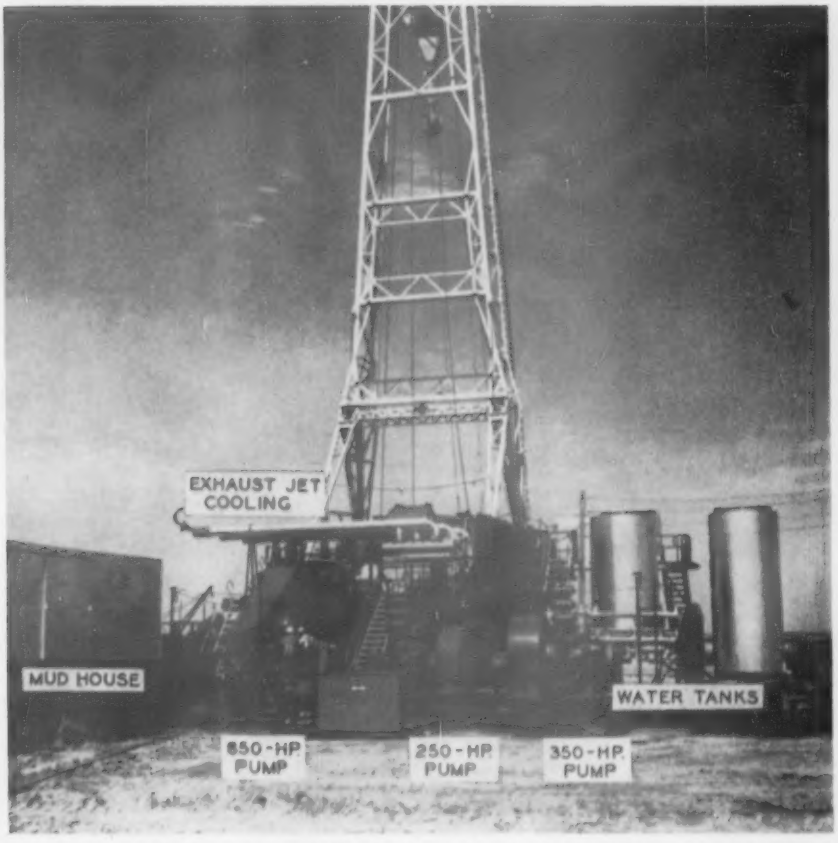
HEAVY MAST, 142-ft. high, will stand a hook load of 500 tons. Draw works is the one used to break the depth record. Fig. 1.



POWER for drilling and mud circulation is provided by three 630-hp. engines. The 850-hydraulic-horsepower pump is on the compound while the other pumps have separate drives. Mud house floor is level with mud tanks. Fig. 2.

DRILLING . . . *EQUIPMENT*

Record-Breaking Rig Has New Look

Big, compact, and fast—that's Ohio Oil Co.'s rebuilt deep-drilling rig. It could still break drilling records.

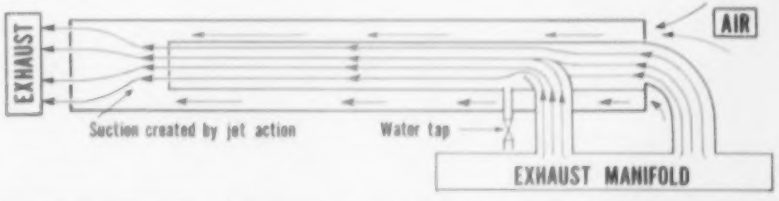
by J. O. Scott
District Editor

OHIO OIL CO.'s record-drilling rig has moved to Oklahoma to tackle deeper drilling in the southern part of the state. Back in 1953, in California, this rig broke drilling records with the then deepest hole of 21,482 ft. But you wouldn't recognize it as the same rig because of the face lifting it has undergone. Here are some of the changes Ohio has made:

- A new 142-ft. jackknife derrick with a load rating of 1,025,000 lb.
- A new substructure.
- New drilling engines.
- A new mud pump with a capacity of 850 hydraulic horsepower.
- New V-bottom mud tanks.

These, as well as the many other features, provide the rig with the capacity to be a pace setter in current drilling where movability, ease of operation, mud-pump power, and mud control are important. It can go to 15,000 ft. with 4½-in. drill pipe with ease. With smaller pipe, it could still break drilling depth records.

Still operating . . . Major equipment items that were on the rig in California



COOLING EXHAUST and engine area is an air-jetting device which pulls air from around engines and past the hot exhaust line. Fig. 3.

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and that are still being used are the draw works (National 125), the block and tackle, and two mud pumps rated at 420 and 250 hp. (at 60 strokes per minute). The block has a 300-ton rating and five sheaves which take 1¼-in. line.

In the future, even the draw works can be replaced by a heavier one. The substructure was fabricated to accommodate this change. In this event, the block would be replaced and sheaves would be regrooved to take 1⅜-in. line. The present crown block has seven sheaves which adapt it to the deepest drilling that may be desired.

Derrick and substructure . . . The new 142-ft. jackknife (Fig. 1) replaces a 178-ft. working space (16-ft. substructure) standard derrick which drilled in California. It is the heaviest that Lee C. Moore makes with this height. For moving it comes apart in four sections. At the fourble board of the derrick as seen in Fig. 1 is a windbreak of ⅛-in. steel. Although this is welded to the mast, it is jointed to come apart when the mast is disassembled.

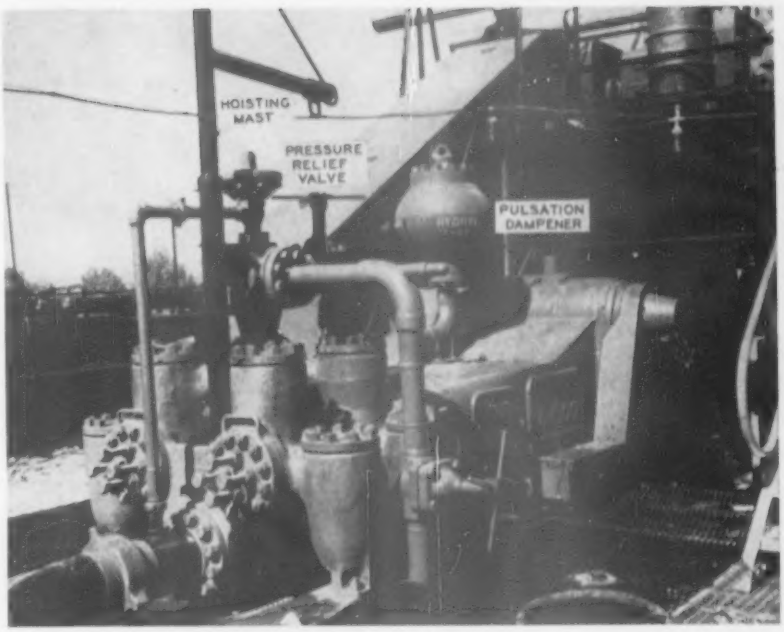
The substructure has two heights—16 ft. under the floor and 10 ft. under the engines. It comes apart in six sections which are pinned together. Every piece of equipment on the rig floor is countersunk, even the pipe-rack flooring. The skids of the substructure are welded to ½-in. steel plates which do away with the need for timber flooring.

All pipes in the substructure are supported by hangers with clamps that allow parts to be replaced easily. And wherever the substructure breaks the pipes have unions. These features considerably speed rigging up and down.

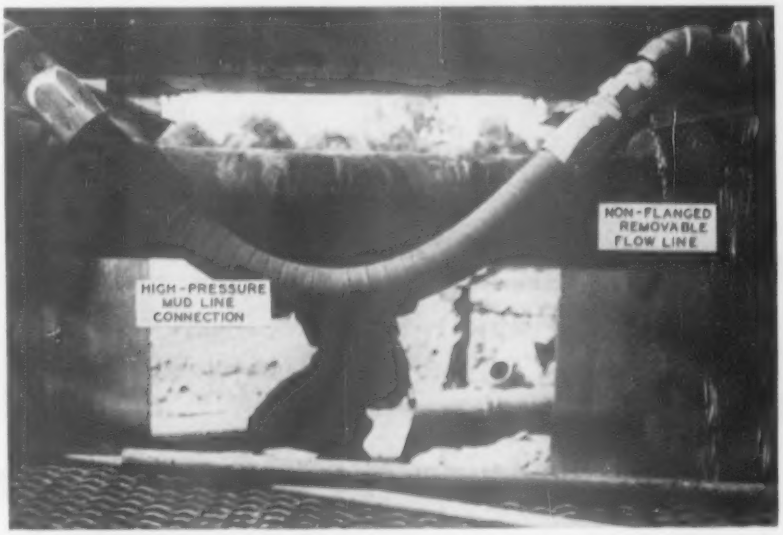
Drilling power . . . Main power on the rig comes from three 630-hp. gas or butane engines. Starting power for the engines is compressed air which goes directly into the cylinders. These are attached to the chain compound through torque converters. The compound drives the draw works and the main 850-hp. mud pump (National G-1000). V-belts attach the pump to the compound.

Rotary power is provided by a 26-in. table with an independent drive. This is an engine driving through a torque converter with two forward speeds and a reverse. The engine fits into one corner of the floor.

Two 300-hp. engines at ground level drive the two auxiliary mud pumps. Starters for these engines are air motors. The 250-hp. pump is normally on the mud guns while the 350-hp. pump is a standby drilling pump. On occasion both can operate at one time.



MUD-CIRCULATION pump will provide plenty of jet-bit power with an output of 850 hp. Hoisting mast is convenient for handling valve covers and liners. Fig. 4.



RIGGING UP is aided by the flexible connection for the high-pressure mud lines and the self-sealing flow-line opening. Exact tank alignment is not necessary. Fig. 5.

Exhaust cooling . . . As may be seen in Figs. 1 and 2 the exhaust pipes on the three main drilling engines are covered by a large pipe. This is to help remove heat radiated from the exhaust and engines and to keep the engine space cooler.

As Fig. 3 shows, the cover pipe is open at both ends. It extends past the end of the exhaust discharge. As the hot gas emerges from the end of the exhaust it creates a jet or venturi action which sucks air through the annular space. This suction moves hot air from around the engines and at the same time cuts down the radiation from the exhaust pipe. A water line also is connected to the exhaust line so that the exhaust may be completely quenched during hazardous testing conditions.

Mud systems . . . Fig. 4 is a closeup of the main drilling pump. It has a 16-in. stroke and liner sizes from 6 to 8½ in. and produces 850 hydraulic horsepower. On the discharge line are a pulsation dampener and a pressure-relief valve. The other pumps shown in Fig. 2 also have pulsation dampeners. The 350-hp. is 18 by 7¼ to 5 in. and the

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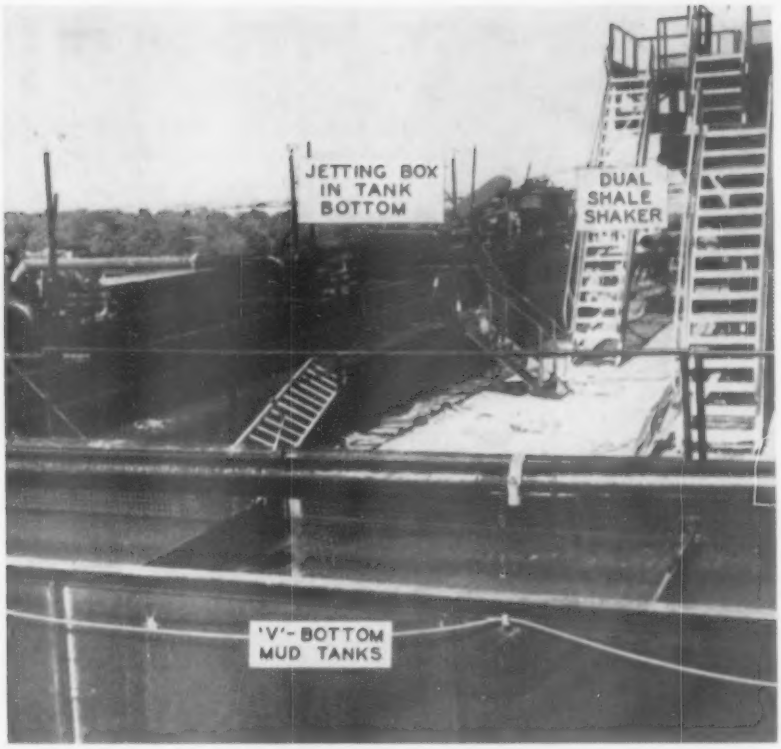


MUD SYSTEM includes dual shale shaker and V-bottom mud tanks. A 1-ft. square box built below the V allows jetting lines to suck mud tanks completely dry. Fig. 6.

250-hp. pump is 15 by 7¼ to 5 in.

The main pump sits on a cradle which is doweled and bolted to the substructure. When the pump is once lined up it doesn't need adjusting again. After the cradle is pinned into place the pump-drive sheaves automatically line up with the sheaves of the compound. The pump cradle rests on ½-in. steel plate just as the substructure.

A very useful tool shown with the big mud pump is the mast for lifting valve covers or supporting pump liners. With this big pump it is a big help in minimizing mashed fingers and hurt feet. The boom of the mast as seen in Fig. 4 will pivot completely around. The collar on the boom will slide its full length. This allows any part to be easily reached.

The steel mesh around the pump makes it a lot easier to change valves or liners. It keeps the men out of the mud and brings them up to a convenient working height.

. . . **Mud lines** are manifolded in a skid under the steel mesh and the board floor of the other pumps. The size of this manifold may be seen in Fig. 2. Valves rising through the floor direct the mud flow. All piping in the manifold breaks by unions to speed rigup and maintenance. Shock hoses take the mud from the pumps to the substructure.

Two mud lines lead from the pumping manifold to the standpipe. The main pump can be hooked to one and the standby pump can be pumping into the other. For cementing operations, provision is made on one line to connect a vertical pipe through the floor to the cementing head. Cementing trucks can attach their lines directly into this mud line without having to pass their pipe up over the floor. When time comes to chase the plug down, the mud pump is directly connected and ready.

. . . **Mud tanks** have connections that are a big aid in rigging up the equipment. Shown in Fig. 5 are the high-pressure mud line and the flow line between two tanks. High-pressure lines to the guns are welded to the steel tanks but come apart quickly by means of the flexible hose connection. The 10¾-in. flow line shown is not attached to either tank. It merely passes into the opening on both tanks. A rubber seal within the tank opening prevents mud leakage.

This type of flow connection can be made even if the tanks are not exactly aligned. When time comes to rig down, the pipe is pulled out of one tank and shoved into the other tank for moving.

The three 40-ft. long steel mud tanks (Fig. 6) each have V-bottoms to aid concentration and removal of settled solids. The depth of the pitch is about 12 in. An additional feature that will let the tanks be completely cleaned out is a jetting box welded on below the V and opening to the tank. This is a steel box about 1 ft. square. The inlet of the jetting lines are thus below the bottom of the tank so that all the mud can be sucked out thus erosion of the tank is minimized.

Shown in the background of Fig. 6 is the dual shaker used on the rig. By means of a steel ditch which runs along the top of each tank it can pass mud to any tank. This is extremely helpful during testing where the mud might become contaminated. Contaminated mud can get from the shaker to the suction tank without affecting good mud which would be stored in the other tanks.

Each mud tank also has a divider over which the mud usually flows during circulation. This is another feature which aids good mud maintenance. A door in the divider will allow low-level operation, if necessary.

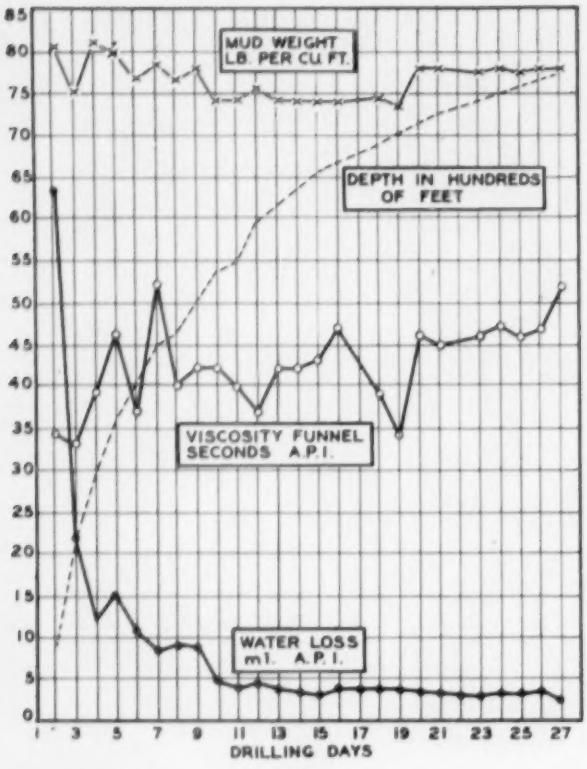
. . . **The mud house** is made completely of steel plate with sliding doors. It is 30 by 8 ft. As shown in Fig. 2 it sits on a base which brings it to the height of the suction tank. The mud hopper and baffled mixing tank shown in Fig. 2 are being rearranged to aid mud mixing. When this is done, the hopper will be in the mud house and will discharge into the mixing tank which will be mounted over the suction tank.

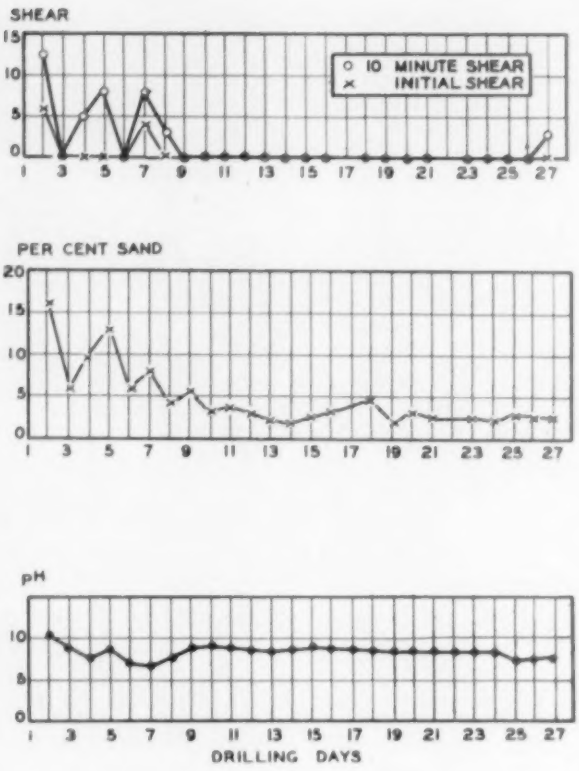
Auxiliaries . . . At present Ohio's rig has three a.c. generators rated at 30, 40, and 50 kw. Each has a separate engine.

Two 5YC compressors on compound are used for supplying air for clutches and throttles. They carry 125-psi. pressure.

Compressed air at 250 psi. serves to start engines as well as to operate the blowout preventers. A 4YC and a 3YC compressor supply this air through an air reservoir of 9⅝-in. casing, 20 ft. long. They are staged by pressure regulators so that both won't come on at the same time. They are also rigged with a regulator to step them down to 125 psi. for use in the main air system.

The hydraulic closing unit of the preventers sits 150 ft. from the rig during drilling operations. Regular hydraulic fluid passing through 1-in. lines operates the preventers but the fluid is pumped by an air pump. A manifold on the rig floor contains air controls which pass pressured air to the air pump.





DRILLING . . . *METHODS*

Convenient Chart Aids Mud Study

by D. H. Stormont
District Editor

WHEN the mud data gained from drilling a well is not put into a readily usable form, valuable cost information which could be applied in drilling nearby wells often is overlooked. The chart and list of materials presented here have been found helpful in remedying this situation.

Mud costs account for a sizable portion of total drilling costs. Whereas per-foot drilling costs have dropped in the past 10 years, mud costs have increased. One large West Coast company figured its mud bill last year averaged $1.04 per foot for a 7,000-ft. California well. It constituted over 5 per cent of the total cost of drilling and completing such wells.

Daily reports on mud characteristics and material purchased now are kept on nearly all wells drilled. In many cases, however, the data never is assembled in a form which can be readily used for comparative cost studies. Thus utility of the data largely is lost.

The chart shown here was developed by Oilwell Research, Inc., Long Beach, Calif. It is submitted to the operators of wells on which the firm has acted as mud consultant. The data shown are that for Golden West Oil Co.'s 1 Board of Supervisors, drilled last year in Sunset Beach field.

MUD MATERIALS CONSUMED IN GOLDEN WEST OIL CO.'S SUNSET BEACH WELL

Material—	Cost
Aquagel, 96 sacks	$ 204.86
Caustic soda, 7 drums	55.13
Quebracho, 52 sacks	473.88
P-95, 60 sacks	54.00
Aeropan, 88 sacks	1,683.00
Wyogel, 150 sacks	320.10
Macco Quebracho, 10 sacks	104.75
Maccohex, 20 sacks	182.00
Maccofos, 20 sacks	191.00
Driscose, 10 sacks	405.00
Yuba Barite, 513 sacks	982.40
	$4,656.12
Sales tax	$ 139.68
Delivery	142.80
Total	$4,938.60
Depth: 7,963 ft., cents per foot	62.0
30 days, per day	$ 164.62

Data plotted were obtained from the daily mud checks. They include curves for weight, viscosity, water loss, initial and 10-minute shear, sand content, and pH. Day-to-day progress of the well also is plotted.

Materials consumed are presented in tabular form. As shown, mud costs for the Golden West well totaled about $4,900. They averaged 62 cents per foot.

The summation is particularly helpful for comparative purposes since it shows just what materials were used.

Care should be exercised, however, in making comparisons solely on a dollars and cents basis. One well, for example, may require more weighting material than an offsetting well requires. Likewise a water-base mud may be used in one and an oil-emulsion mud in another. The chemicals required for maintaining a low water loss, oil-free mud can be quite expensive.

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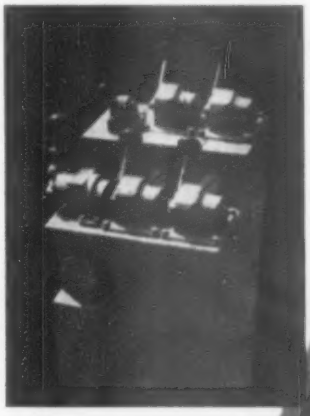
● **SINGLE TRAILER MOUNTING** gives minimum rig up time, maximum portability. Rig is 8 feet wide, 50 feet long, and weighs 50,000 pounds.



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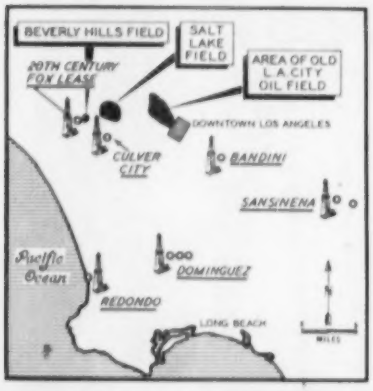
SANSINENA FIELD is in region overlooking golf course and expensive residential homes. This is Fred Johnson Drilling Co.'s rig drilling for Union Oil Co.

CULVER CITY development is sandwiched in between used-car lots and light industrial plants. Sun Drilling Co. is drilling this wildcat for E. W. Pauley.



OIL FIELDS swallowed up by residential developments exist throughout Los Angeles Basin. Stars are location of soundproofed rigs.

DRILLING . . . *METHODS*

Drilling Is Hush-Hush Operation in L. A. Basin

When old fields are engulfed by growing cities, later development is difficult. Untapped pays may make operations worth while, but drilling faces severe problems

by W. T. Smith
District Editor

DEEPER pay possibilities in and around many old shallow oil fields in the Los Angeles Basin are being tested today which could not have been drilled a few years ago. Slant drilling with completely soundproofed rigs and sufficient background for a comprehensive public education program are the principal reasons.

Prejudices against drilling in highly developed residential and industrial districts have gradually diminished as contractors and operators have eliminated and reduced most of the objectionable features of such drilling.

The incentive for the development and improvement of such drilling techniques is seen in a glance at a Los Angeles Basin map.

There are a number of oil fields in the basin which have been swallowed up by residential and business developments. Typical of these are the Los Angeles, Salt Lake, and Beverly Hills fields.

Oil fields in the city . . . With the growing success in California of deeper drilling around and within known oil fields, plus the development of sound-

BANDINI FIELD in east Los Angeles has this well location of General Exploration Co. adjoining frozen-juice factory. Fowler Drilling Co. is the contractor.

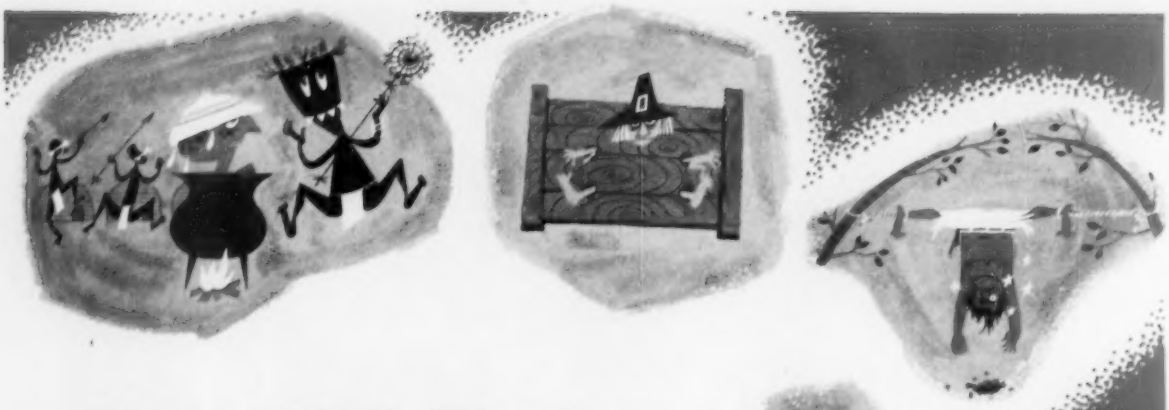
BEVERLY HILLS field still produces from pumpers while drill explores further. Contractor for Universal Consolidated Oil Co. on this movie lot is Sun Drilling Co.

proofing techniques, operators are beginning to look with renewed interest at some of these old fields. It's almost impossible to find a place to park a car within the limits of most of these old fields, let alone find a drill site. So moves have been made recently towards possible use of city owned parks to locate drilling islands and here the science of soundproofed operations will play an important role.

Los Angeles City oil field, which is located within 1 mile of the city hall, is still producing 130 bbl. daily from 80 stripper wells. The deepest wells in the field are less than 1,700 ft. Most are less than 1,000 ft. deep. Between 1898 and 1900, more than 1,000 wells were drilled in the field.

Another case in point is Salt Lake oil field in the western part of residential Los Angeles. At its peak year in 1908 this shallow field produced 4,535,800 bbl. of oil. Production decline coupled with population encroachment made the property more valuable as homesites than as an oil field with the result that there are only two wells left in the field producing a total of 60 bbl. daily. However, at least one report indicates that there is a still untapped productive zone at less than 4,000 ft. The deepest wells in the field were around 3,200 ft. with wells on the northwest

DOMINGUES FIELD is the location of these three soundproofed rigs of Lee Daniels Drilling Co. which are drilling for J. K. Wadley. Rigs back up against a medium-priced housing project.



We're Glad It's Over

These simple little forms of torture are mild and unimaginative compared to what we've been through. During the move to our new plant in Waxahachie we lost a lot of production and our deliveries were slowed. And, to a dedicated sales organization, no greater torture is conceivable.

But things are looking up now.

Products are moving out to our customers.

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Our beleaguered salesmen, although bruised, battered, buffeted and brow-beaten, are showing signs of ultimate survival. Our shattered and shaken sales manager drew sufficient sustenance from his dream to enable him to begin the slow creep back toward the lofty peak of his former greatness. *(Guess who wrote this.)*

Yes, things are looking up now but it was a terrific task to move — lock, stock and barrel — from St. Louis to Waxahachie and to train practically an entirely new force. Those charged with these responsibilities worked day and night, weekends and holidays in order to get the job done. We're all glad it's over.

Please accept our apologies for our past inability. Each slight inconvenience to you was a nightmarish experience to us but now we're in a position to serve you better than ever before. We're proud of our new plant and we hope you'll come to see us — soon.

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flank being only 900 to 1,800 ft. deep. Total production in this shallow field is in excess of 43,000,000 bbl.

Passage of city ordinances severely restricting, and in many cases prohibiting, any more drilling hit the field early in its life so that deep-zone tests have never been conducted there.

Typical example . . . Typical of the development of drilling in residential and industrial districts is Union Oil Co.'s experience at Sansinena near suburban Whittier east of Los Angeles. Here Union faced the problem of obtaining the consent of local residents who, 10 years prior, had formed citizen improvement committees to successfully keep drilling out of the area.

Despite the fact Union had mineral-fee property, it was eventually required to meet rigid drilling restrictions plus pay a bonus to surface owners. Because of these restrictions, plus the high cost of property, Union used 12 drilling islands to develop the field. More than 90 per cent of the 146 producing wells drilled there were slant-drilled from these islands.

Some of the regulations Union faced at Sansinena, and which are typical of those facing other operators involved in this type of drilling, include:

1. Rig and related equipment must be completely soundproofed. This has been accomplished with the use of heavy plastic mats encasing the rig. This requirement adds about $10,000 to the cost of each well.

2. Derrick doors must be closed at all times except when vitally necessary for them to be open. Drilling noise must be kept at absolute minimum.

3. A definite time limit for completion of drilling is set prior to spudding in.

4. Minimum capacity storage facilities.

5. Truck traffic heavier than pick-ups restricted to the hours 8 a.m. to 6 p.m. This means that all material, logging, or cementing requirements must be anticipated so as to be on the drill site before 6 p.m. and cannot be removed before 8 a.m. the next morning.

6. Drill site protected by 6 ft. chain-link fence and entire area landscaped to conceal operations.

7. Structures and equipment must be painted so as to blend with natural surroundings.

8. Pumping operations restricted to bottom-hole pumps powered by muffled engines enclosed in an insulated soundproof building.

In addition to a number of cleanup requirements, including no sumps left on the property, the conduct and language of the drilling crews have also been subject to severe restrictions.

REDONDO BEACH tidelands drilling is squeezed in between small homes and the breakwater holding back the Pacific Ocean. Santa Fe Drilling Co.'s rig is working for Signal Oil & Gas Co.

Fred Johnson Drilling Co. is currently on two soundproofed jobs for Union at Sansinena. One adjoins a golf course. However, so effective is the rig's soundproofing that the irate outbursts of the duffers missing 18-in. putts can be clearly heard from 200 yards away while standing right next to the rig.

Movie lot . . . Another major soundproofing operation in the Los Angeles Basin is at Universal Consolidated Oil Co.'s 20th Century Fox Studio lease in West Los Angeles.

Here the rapid growth of the city engulfed the old Beverly Hills field area before it could be thoroughly explored with the bit. By the time Universal became interested, the district was completely developed with expensive residential structures and schools.

However, after lengthy negotiations with property owners and civic bodies, Universal received the nod on the movie-lot drilling site. As at Sansinena, expensive noise-abatement and site-beautification restrictions were involved.

Universal paid out $3,000,000 for the first seven wells on the lease. Compliance with all the restrictions upped the ante 75 per cent per well. Eight wells slant-drilled from the single site are currently producing 3,000 bbl. daily.

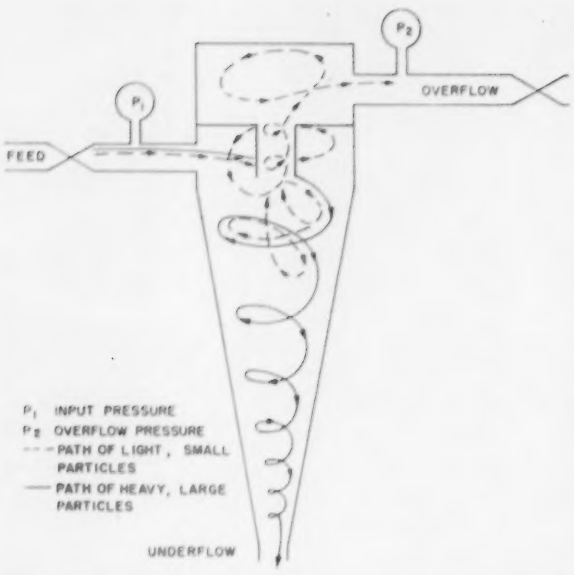
Universal is using a 136-ft. derrick completely encased in a 1½-in. fireproof plastic coating. All power on the rig is electric. The drill site is recessed in the side of a hill with concrete-reinforced walls on three sides. Sun Drilling Co. is the contractor on the job.

Others . . . In the northwest edge of old Dominguez field in southeast Los Angeles Lee Daniels Drilling Co. is currently operating three soundproofed rigs for J. K. Wadley on a lease adjoining a medium-priced housing tract. The three rigs are operating within 50 ft. of the houses.

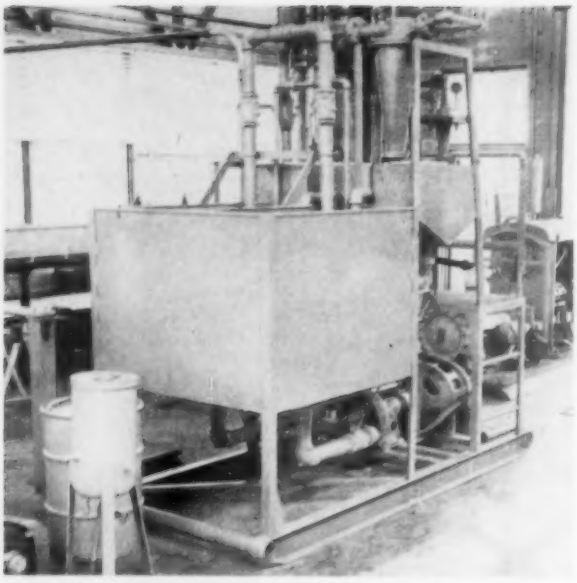
Sun Drilling Co. has another soundproofed rig on an exploratory well for Edwin Pauley, independent operator, on a lease in Culver City. Here the operator faced severe space restrictions as well as soundproofing regulations. The drill site is sandwiched in between light industrial plants and used-car lots.

At Redondo Beach Signal Oil & Gas Co. has Santa Fe Drilling Co. slant-drilling its offshore lease from a soundproofed rig at an onshore site. Santa Fe was drilling Signal's fourth well on the six-well site. This rig is on the edge of the city's breakwater with the wells bottomed out under the Pacific Ocean.

General Exploration Co. has a development program under way in Bandini field which requires the use of soundproofed rigs. Fowler Drilling Co. is the contractor on this lease which is in the midst of a light industrial district in east Los Angeles. Bandini field has experienced a recent upswing in activity as a result of two new pool discoveries made there earlier this year by General Exploration and Richfield Oil Co.



FLOW PATTERN in the cyclone produces centrifugal forces which cause particle separation. Heavy large particles go to the sides and out the bottom while light small particles go out the top. Fig. 1.



LAB APPARATUS consists of mixing tank (foreground), two V-bottomed gage tanks; 8-in. and 3-in. cyclones (over gage tank), pump and motor (on base of skid). Fig. 2.

DRILLING . . . *METHODS*

Cyclones Save Barite, Reject Clay Solids

PART 1

by P. P. Scott, Jr., and J. L. Lummus

Stanolind finds that treatment of weighted drilling fluids with 3-in. cyclones will remove as much as 95 per cent of the clay and reclaim as much as 95 per cent of the barite. Removal of clays from high-clay-content lime-base mud by cyclone treatment will reduce gelation at high temperature. During field tests, barite and chemicals savings amounted to $8,700 in 14 days on one well and $10,000 in 3 days on another well. Three-inch cyclones are currently being used routinely for mechanically controlling the viscosity of drilling fluids by removing dispersed clay solids.

Laboratory and field tests have been conducted using cyclones to remove clay solids while reclaiming barite and lost-circulation materials, and to remove bit cuttings and sand while retaining lost-circulation materials. Part 1 of this paper presents the results of these tests. Part 2, which will be published at a later date, will discuss the use of the 8-in. cyclone for removing cuttings and sand from drilling fluids.

LABORATORY and field tests using cyclones to remove clay solids while reclaiming barite from drilling muds show the following results:

1. A 3-in. cyclone may be used to reclaim as much as 95 per cent of the barite and reject more than 95 per cent of the clay from weighted drilling fluids when the feed to the cyclone is diluted with water.

2. The higher the dilution ratio of the feed to a 3-in. cyclone the more efficient is the recovery of barite and rejection of clay.

3. The higher the input pressure, the more efficiently a 3-in. cyclone recovers barite and rejects clay; however, at an input pressure higher than 60 psi., wear on the cyclone is accelerated.

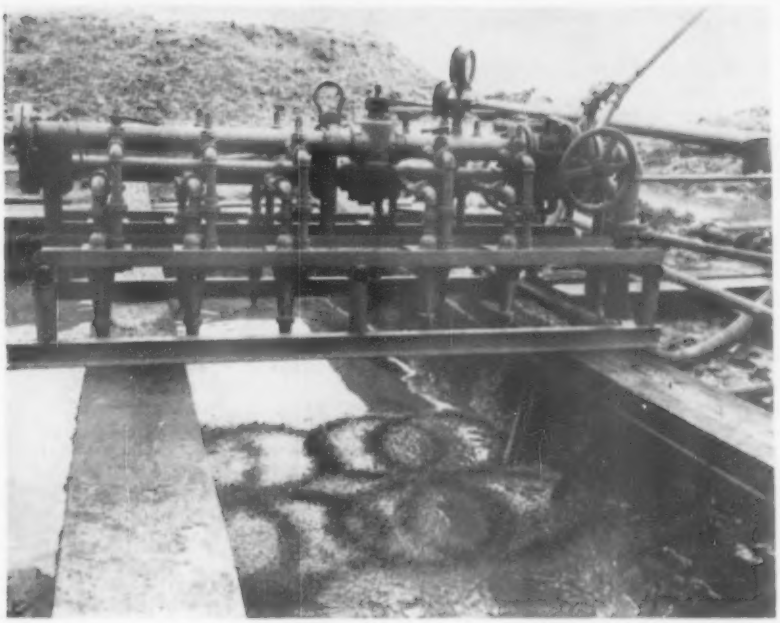
4. By adjusting the overflow valve of a 3-in. cyclone, the underflow weight may be varied from a value equal to the weight of the diluted input mud to a weight of more than 18 lb. per gal.

5. The weight of a mud system may be maintained constant when treated with 3-in. cyclones by adjusting the underflow weight to a value equal to the weight of the mud in the system.

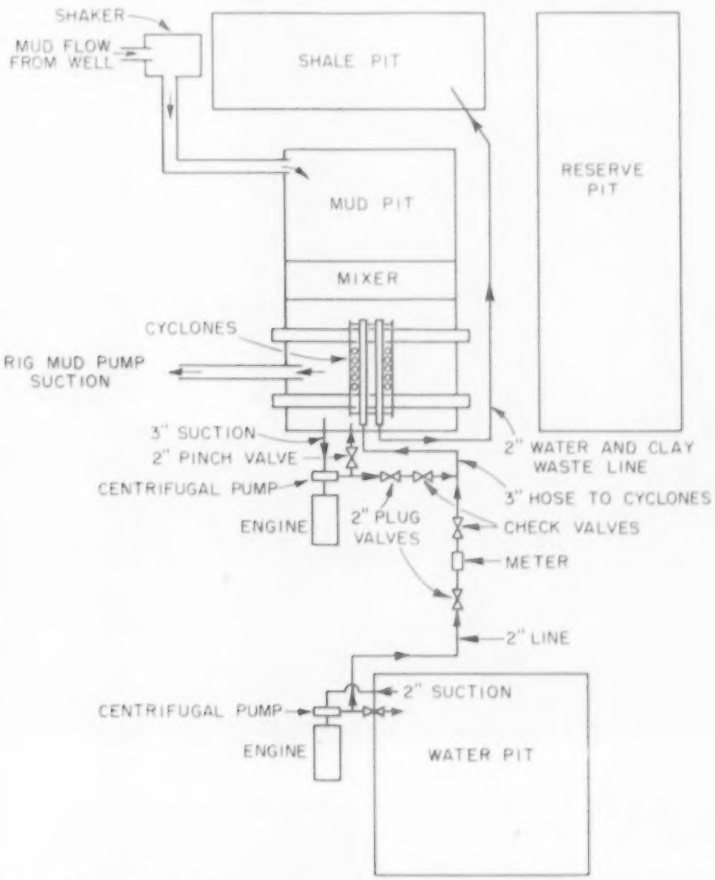
6. For the most efficient operation in the field when the mud weight must be held constant, the dilution ratio of the feed and the back pressure of the cyclone should be adjusted to provide an underflow weight equal to the weight of the mud in the mud system and an overflow weight of less than 9.0 lb. per gal.

7. When the overflow has a weight of less than 9.0 lb. per gal., a 3-in. cyclone will recover more than 90 per cent of the finely ground lost-circulation materials, such as walnut shells, mica, and cellophane flakes.

8. Drilling fluid containing coarse lost-circulation materials and cuttings tend to plug a ¼-in. diameter underflow orifice of a 3-in. cyclone. However, passing the fluid over a conventional shale shaker removes the large



MANIFOLDED CYCLONES for field use sit over mud pit for barite recovery. The concentrated barite stream leaves the bottom of the cyclone and the rejected clay solids go to the shale pit. Fig. 3.



EQUIPMENT LAYOUT shows how cyclones were used on Louisiana well. Besides cyclones, major equipment is two centrifugal pumps with their drives. Fig. 4.

particles so that a ¼-in.-diameter underflow orifice can be used.

9. Drilling fluid containing coarse lost-circulation materials may be treated with a 3-in. cyclone having a ½-in.-diameter underflow orifice.

10. Drilling fluids weighing 13.0 lb. per gal. or less may be treated with a 3-in. cyclone without diluting with water if the underflow is adjusted to a weight higher than 18.0 lb. per gal. but recovery of barite will be at a reduced efficiency.

11. A 3-in. cyclone is more efficient for recovering barite and rejecting clay than an 8-in. cyclone.

12. Cyclone treatment to remove clays from lime-base muds reduce high-temperature gelation.

13. Approximately 4 hours' daily operation of eight 3-in. cyclones will maintain a constant viscosity of the drilling fluid under average drilling conditions in Gulf Coast wells.

14. Continuous treatment of a mud system of weighted drilling fluid with eight 3-in. cyclones removes dispersed clays so efficiently that a viscosity increasing agent must be added to keep the barite in suspension.

15. Emulsified or free oil and chemicals present in drilling fluids fed to a 3-in. cyclone are lost in the overflow; however, no more oil and chemicals are lost for each pound of clay recovered by treating with a cyclone than wou'd be lost by jetting.

Description of Cyclones

Essentially, the cyclone consists of

THE AUTHORS

P. P. SCOTT, JR. **J. L. LUMMUS**

P. P. Scott, Jr., is a research engineer in the research department of Stanolind Oil & Gas Co., Tulsa. He received his degree in petroleum engineering from University of Oklahoma in 1941. During World War II he was a major in the field artillery. He joined Stanolind in 1946 as an engineer in West Texas and was transferred to Tulsa as research engineer in 1948. He is a member of the A.I.M.E.

J. L. Lummus is a technical group supervisor in the research department of Stanolind. He graduated from Erskine College in 1942, majoring in chemistry and physics. He was with Du Pont until 1944 when he entered the U.S. Navy. Joining Stanolind in 1946 he became research chemist in 1949 specializing in drilling-mud research. He assumed his present position in 1953.

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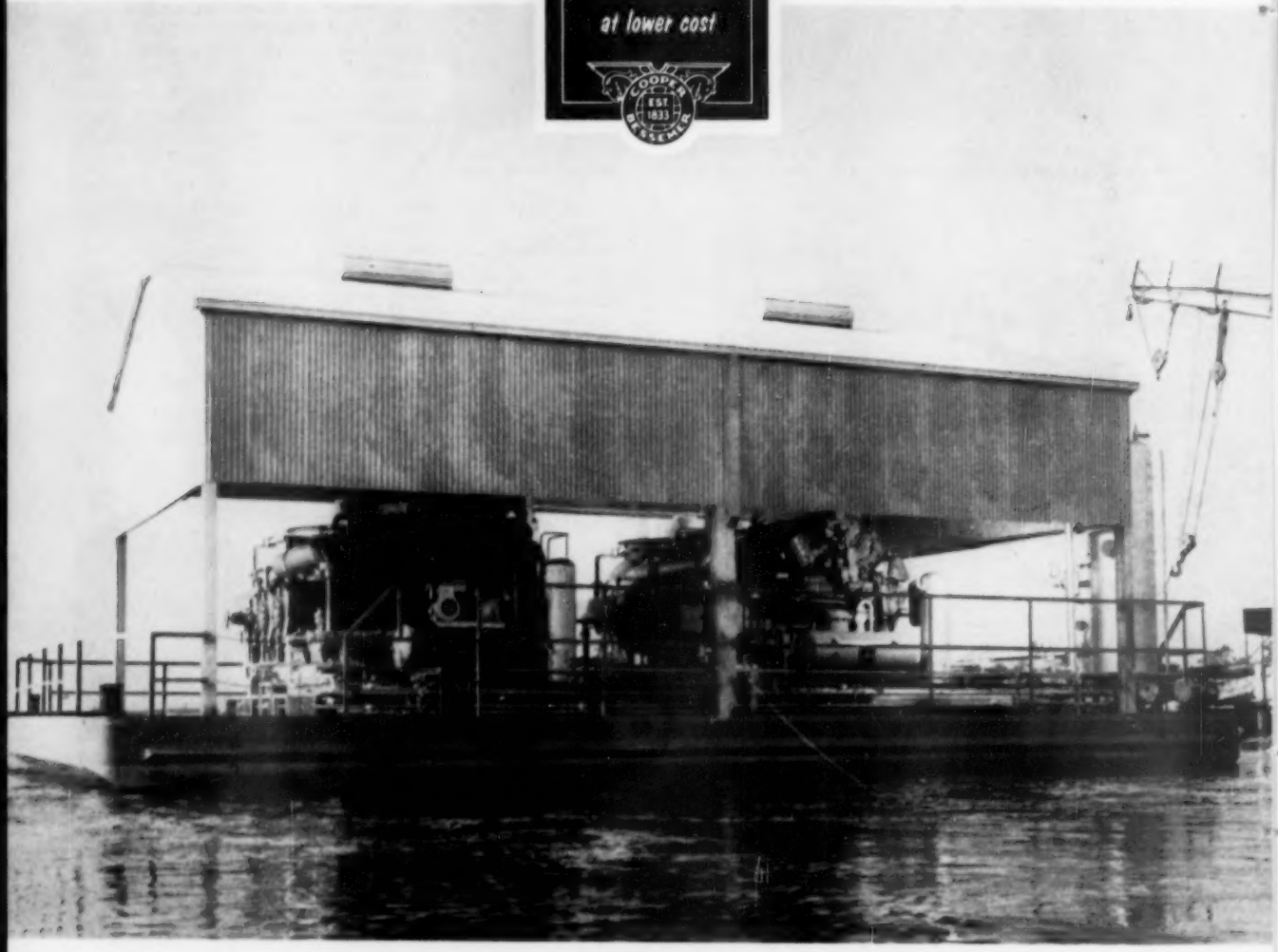

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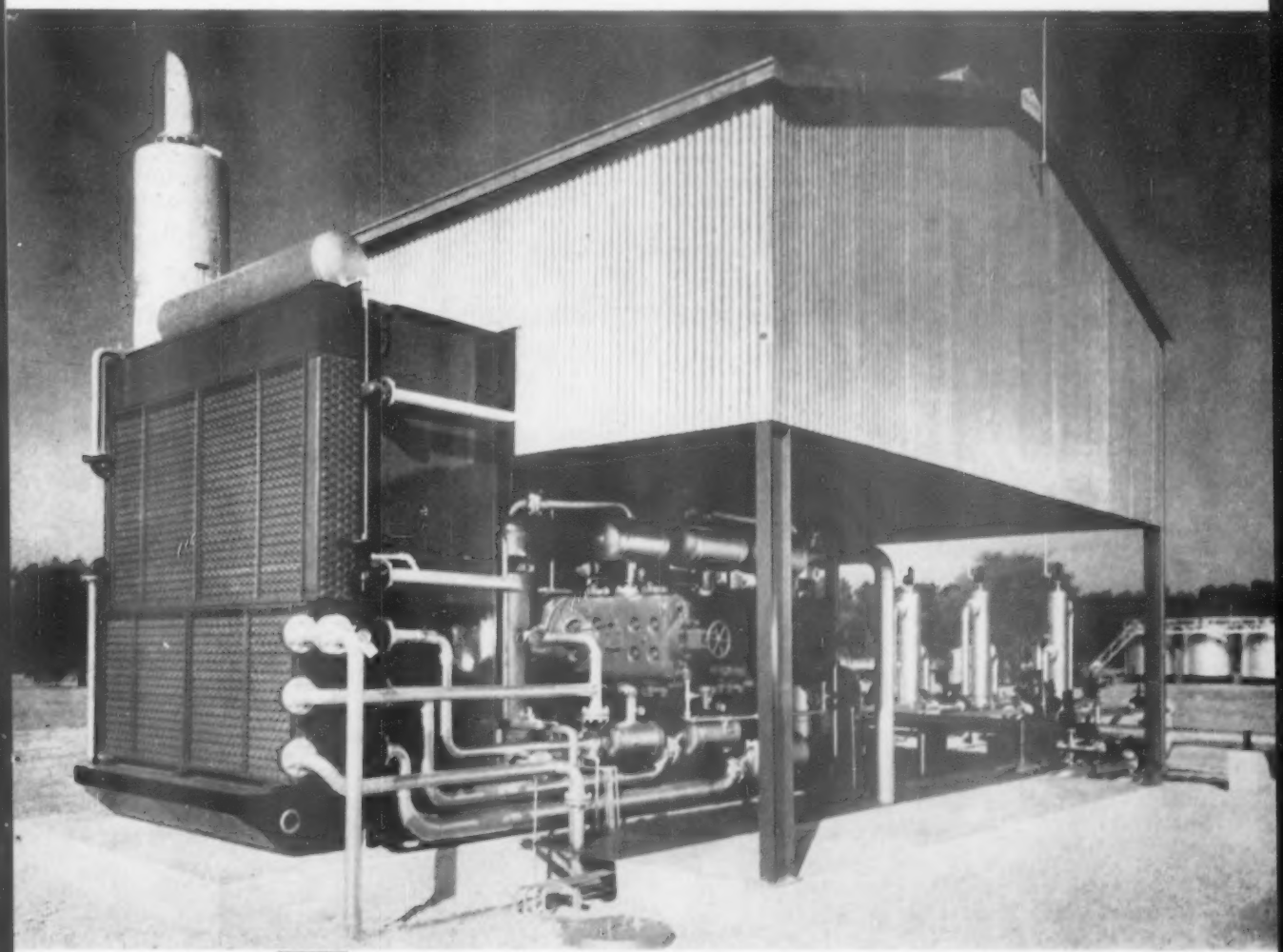

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an inverted cone-shaped body containing three openings—a tangential inlet near the top of the conical section, an outlet at the bottom or apex (underflow), and an outlet at the top (overflow). There are no moving parts. Normally, for convenience of operation, the apex of the cone is pointed downward; however, since the force of gravity is so small in comparison to the other forces in the cone, the cyclone may be operated in any position.

Different sizes of cyclones are identified by the internal diameter at the top of the conical body. Commercially available cyclones vary in diameter from a few millimeters to more than 2 ft. For the control of drilling fluids, cones having diameters in the range of 2 to 14 in. will probably be most suitable. At an input pressure of 40 psi., the capacity of the 8-in. cyclone is 100 to 200 g.p.m. At the same pressure, the capacity of a 3-in. cyclone is 10 to 15 g.p.m. The capacity of any particular size cone will vary with manufacturer because of differences in design.

Operation . . . Briefly, the cyclone operates as follows: Fluid containing suspended solids enters tangentially at the upper part of the cone body at a high velocity. The centrifugal force produced causes the heavier, larger particles to move to the wall, toward the apex of the cone and out the underflow orifice. Lighter, smaller particles having less tendency to move to the wall are forced to the overflow by the upward velocities at the core of the cyclone.

A simplified pattern of flow in a cyclone is shown in Fig. 1. The volume of fluid and the concentration of solids at the underflow and overflow may be varied by changing the input pressure (P_1) and the back pressure (P_2) at the overflow. The underflow normally discharges to atmospheric pressure.

Testing Apparatus

Laboratory . . . Laboratory testing apparatus consisted of 3-in. and 8-in.-diameter cyclones fed by a single-stage, open-impeller, centrifugal pump actuated by an electric motor. Fig. 2 is a photograph of the test setup showing the cyclones, mixing tanks, gage tanks, pump, and motor.

Field . . . For removing clay and reclaiming barite during field tests, a manifold of ten 3-in. cyclones was used. Fig. 3 is a photograph of the manifold. Mud was fed to the cyclones with a semiopen-impeller centrifugal pump actuated by a 14-hp. diesel engine. A closed-impeller centrifugal pump, also actuated by a 14-hp. diesel engine, furnished water to the cyclones. A disk-type of water meter was used to measure the flow rate of the water. A layout of the cyclones and pumps with respect to the earthen pits for the field test on a well in Big Lake field, Louisiana, is shown in Fig. 4. A similar layout was used with steel pits on a drilling barge near Buras, La.

Laboratory Tests

Weighted drilling muds were pumped through 3-in. and 8-in. cyclones. Variables studied were barite and clay content of the input mud, input and overflow pressure, and water-mud dilution ratios. Flow rates, density, clay concentration, and barite concentration of the overflow and underflow were measured. In most cases, the input mud was diluted to such an extent as to make the viscosity of the feed an insignificant factor.

To simplify interpretation of the re-

Table 1—Expected Field Performance of 3-in. Cyclones When

ASSUMPTIONS:
Volume of mud system: 1,000 bbl.

(1) Example No.	(2) Drilling fluid	(3) Dilution (water/mud)	(4) Pressure (psi.) In	(5) Pressure (psi.) Over	(6) Mud weight (lb. per gal.) Input Before dilution	(7) Mud weight (lb. per gal.) Input After dilution	(8) Mud weight (lb. per gal.) Reject or over	(9) Mud weight (lb. per gal.) Reclaim or under	(10) Total volume mud and water through cyclones (bbl.) Feed	(11) Total volume mud and water through cyclones (bbl.) Over	(12) Total volume mud and water through cyclones (bbl.) Under
Lime-base mud (Houma, La.):											
1		1	46	17.5	16.4	12.4	10.7	15.85	200	143	57
2		2.6	46	17	16.4	10.6	9.5	16.15	360	285	76
3		3.2	46	14	16.4	10.3	8.85	15.95	420	344	76
4		3.5	46	13	16.4	9.9	8.8	16.8	450	380	70
5		5.9	44	9	16.4	9.5	8.6	15.8	690	605	85
6		6.5	43.5	9	16.4	9.4	8.5	15.8	750	662	88
7		4	20	4	16.7	10.0	9.05	16.3	500	432	68
8		4	30	8	16.7	10.0	8.95	16.5	500	427	73
9		4	47	14	16.7	10.0	8.8	16.15	500	413	87
10		4	47	12	16.7	10.0	8.85	17.0	500	422	78
11		4	47	14	16.7	10.0	8.8	16.15	500	414	86
12		4	47	16	16.7	10.0	8.8	15.0	500	400	100
13		4	47	18	16.7	10.0	8.75	14.1	500	385	115
Gel-chemical:											
14		None	42	15	12.3	12.3	10.6	18+	100	77	23
Lime-base mud (laboratory):											
15		None	70	20	16.8	16.8	16.55	16.95	100	72	28
16		0.36	59	15	16.8	14.55	13.0	18+	136	106	30
17		3.1	48	5	16.8	10.4	9.3	18.0	410	364	46
18		3.1	48	10	16.8	10.4	9.2	17.0	410	350	60
19		3.1	48	15	16.8	10.4	9.1	16.2	410	342	68
20		3.1	48	20	16.8	10.4	9.0	13.30	410	300	110
Gel-chemical:											
21	(8-in. cone)	0.5	25	5	15.4	13.0	12.9	16.7	150	142	8
22	(3-in. cone)	0.5	25	5	15.4	13.0	12.5	14.6	150	105	45
23	(3-in. cone)	0.5	50	16	15.4	13.0	12.35	14.3	150	93	57
24	(8-in. cone)	3.34	24	7	15.4	9.95	9.7	16.3	434	401	33
25	(3-in. cone)	3.34	25	9	15.4	9.95	9.0	15.7	434	373	61
26	(3-in. cone)	3.34	40	13	15.4	9.95	8.9	15.2	434	364	70

sults of laboratory tests, calculations were made of the percentage of clay which would be rejected and the amount of barite which would be reclaimed and lost in a 1,000-bbl. mud system by passing 100 bbl. of the mud through a 3-in. cyclone. These calculations, based on the performance of the cyclones observed during laboratory tests, are shown in Table 1.

Also shown is the amount of barite which would be lost in obtaining the same reduction of clay by jetting the pits and rebuilding the volume with water and barite, the amount of barite saved by cyclone treatment compared to jetting, the amount of barite lost for each 1 per cent reduction in clay by jetting, the percentage of barite saved by cyclone treatment compared to jetting, and the value of the barite saved by cyclone treatment as compared to jetting for each 1 per cent clay reduction.

Table 1 is read as follows (the numbers in parentheses refer to the column number in Table 1): In Example No. 1, mud weighing 16.4 lb. per gal. (6) was diluted with one part water (3) by volume before passing through the cyclone. Using an input pressure of 46 psi. (4) and an overflow pressure of 17.5 psi. (5), 57 bbl. of mud (12) weighing 15.85 lb. per gal. (9) appeared at the underflow and 143 bbl. of mud (11) weighing 10.7 lb. per gal. (8) appeared at the underflow when 200 bbl. of water and mud (10) (100 bbl. mud and 100 bbl. water) were fed to a 3-in. cyclone. Of the 408 sacks of barite (13) in the feed, 160 sacks (14) were rejected and 234 sacks (15) or 57.4 per cent (16) were reclaimed. Of the 6,000 lb. of clay (17) in the feed, 4,300 lb. (18) or 72 per cent (20) were rejected and 1,700 lb. (19) were returned to the mud system. When barite and water were then added to the mud system to build the volume back to 1,000 bbl., compensating for the barite lost, the percentage of clay was 7.2 per cent (21) less than before treatment. The barite lost for each 1 per cent reduction of clay in the system was 22.2 sacks (22). If the pits had been jetted instead of conditioned with the cyclone the barite lost for each 1 per cent reduction of clay in the system after the volume was rebuilt back to 1,000 bbl. with water and barite would have been 40.8 sacks (23). To reduce the amount of clay by 7.2 per cent 294 sacks (24) would have been lost. In other words, 134 sacks (25) of barite were saved by treating with the cyclone rather than jetting to reduce the clay content. Barite saved by cyclone treatment compared to jetting was 45.5 per cent (26). The value of the barite, at $2.00 per sack, saved by cyclone treatment, compared to jetting, for each 1 per cent reduction of clay in the 1,000-bbl. mud system amounted to $37.20 (27).

Effect of dilution ratio . . . Examples 1 to 6 in Table 1 show the effect of increasing the dilution ratio of water to mud when treating a Gulf Coast lime-base mud with a 3-in. cyclone and maintaining an underflow mud weight approximately equal to that of the original undiluted mud. As the dilution ratio increased from 1 to 6.5, the amount of clay removed from the treated mud increased slowly from 72 to 88 per cent, but the amount of barite lost for each 1 per cent reduction of clay in the entire system decreased from 22.2 sacks to 3.8 sacks.

The barite reclaimed from the treated mud increased from 57.4 to 91.5 per cent. These results are depicted graphically in Fig 5. The value of the barite saved by cyclone treatment, compared to jetting, for each 1 per cent reduction of clay in the entire system

Treating Weighted Drilling Mud (Based on Laboratory Tests)

Volume of mud treated: 100 bbl.

(13) Total Barites (sacks) Feed	(14) Over	(15) Under	(16) Barite reclaimed (%)	(17) Total clay (hundreds of lb.) Feed	(18) Over	(19) Under	(20) Clay removed from treated mud (%)	(21) Clay removed from entire mud system (%)	(22) Barite lost per 1% reduction of clay in system (sacks)	(23) Barite lost per 1% reduction of clay in system by jetting (sacks)	(24) Barite lost by jetting to obtain same clay reduction obtained with cyclone (sacks)	(25) Barite saved by cyclone treatment compared to jetting (sacks)	(26) Barite saved by cyclone treatment compared to jetting (%)	(27) Value of Barite saved by cyclone treatment, compared to jetting for each 1% clay reduction ($)
408	160	234	57.4	60	43	17	72	7.2	22.2	40.8	294	134	45.5	37.20
408	128	315	71.0	60	48	12	80	8.0	16.0	40.8	327	199	60.1	49.60
408	76	311	80.5	60	48	12	80	8.0	9.5	40.8	327	251	76.8	62.60
408	53	329	86.0	60	49	11	82	8.2	6.5	40.8	335	282	84.1	68.60
408	49	344	87.5	60	52	8	87	8.7	5.6	40.8	356	307	84.0	70.40
408	33	358	91.5	60	53	7	88	8.8	3.8	40.8	360	327	90.6	74.00
423	138	284	67.5	60	52	8	87	8.7	15.9	42.4	369	231	62.5	53.00
423	118	324	73.5	60	51	9	85	8.5	13.9	42.4	360	242	67.3	59.00
423	69	366	84.5	60	50	10	84	8.4	8.2	42.4	356	287	80.6	68.40
423	89	365	80.5	60	51	9	85	8.5	10.5	42.4	360	271	75.3	63.80
423	70	362	84.0	60	50	10	83	8.3	8.4	42.4	354	282	80.0	68.00
423	68	360	85.0	60	48	12	80	8.0	8.5	42.4	339	271	80.0	67.80
423	58	357	86.0	60	46	14	78	7.8	7.4	42.4	330	272	82.4	70.00
160	51	109	68.0	80	61	19	76	7.6	6.8	16.0	122	71	58.2	18.40
443	303	129	29.9	41	35	6	85	8.5	35.6	44.3	377	74	19.6	17.40
443	248	195	43.9	41	37	4	90	9.0	27.6	44.3	399	151	37.8	33.40
443	175	243	58.0	41	39	2	95	9.5	18.4	44.3	420	245	57.4	51.80
443	140	284	66.0	41	39	2	95	9.5	14.8	44.3	420	280	66.6	59.00
443	123	292	70.3	41	38	3	93	9.3	13.2	44.3	412	288	70.0	62.20
443	90	298	76.8	41	34	7	83	8.3	10.8	44.3	368	278	75.6	67.00
389	358	37	9.4	20	19	1	95	9.5	37.8	38.8	369	11	2.6	2.00
389	240	156	39.3	20	14	6	70	7.0	33.0	38.8	272	32	15.2	11.80
389	204	187	48.0	20	12	8	60	6.0	34.0	38.8	243	39	16.0	13.00
389	296	144	32.8	20	18	2	90	9.0	33.0	38.8	350	54	15.2	11.60
389	134	248	65.6	20	17	3	85	8.5	15.7	38.8	330	206	59.6	46.20
389	109	270	71.3	20	17	3	85	8.5	12.8	38.8	330	221	67.0	52.00

MOBILE PLATFORM of new offshore drilling firm is outfitted with . . .

World's Largest Draw Works

HOUSTON—The largest draw works ever built has been installed on a mobile drilling platform being built here for Morris & Hamilton, Inc., newcomers in the offshore drilling business.

The draw works is incorporated in a Wilson Manufacturing Co. Super Titan "66" rig, which is one of the largest ever manufactured. Driven by 2,400 hp., the rig is designed for drilling to 20,000 ft. with 4½-in. drill pipe. With use of 3½-in. pipe it has a depth rating of 25,000 ft.

Independent diesel engines driving the rotary and mud-mixing pumps bring total available horsepower on the entire rig to more than 3,600.

The Lee C. Moore cantilever-type mast has a capacity of more than 1,000,000 lb.

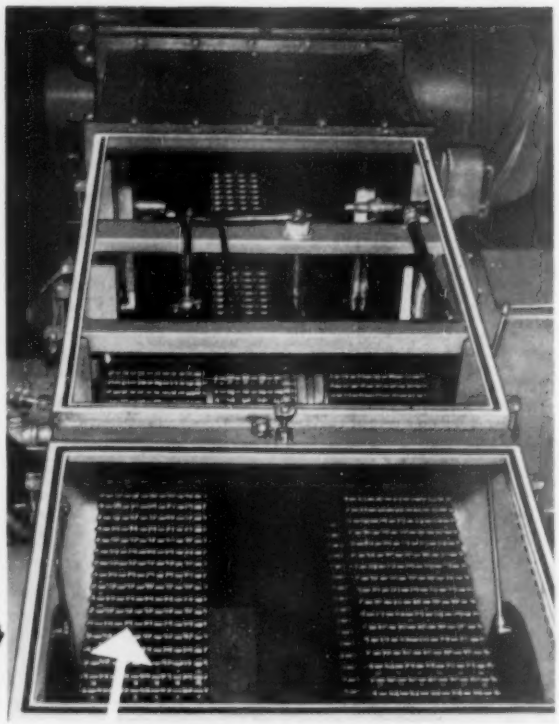
Designed for operations in 30 ft. of water, the platform is Morris & Hamilton's first unit for drilling in the open gulf. The Houston-based company now operates one bay barge and three land rigs.

The mobile platform was dedicated August 17. It is scheduled to leave soon to start drilling for The Texas Co. in 30-ft. water off the Louisiana coast.

Hull of the vessel is 230 ft. long, 99 ft. wide at one end, 75 ft. wide at the slot end, and 11 ft. 9 in. deep. The lower of two decks on the platform is 65 ft. above the bottom of the basic hull. Deck structures are supported by fixed columns.

Sprague Welding & Machine Works employed an unusual technique in constructing the vessel. The upper structure was built on top of the lower hull deck. Then columns were erected and hydraulic jacks raised the superstructure to its present position.

Reproduced from "Oil & Gas Journal" article



Diamond Roller Chain compound shown on Wilson Super Titan "66" Rig.

Dewey Morris of Morris and Hamilton, and John Wilson, President, and Jack Wilson, Assistant to the President, of Wilson Manufacturing Company.

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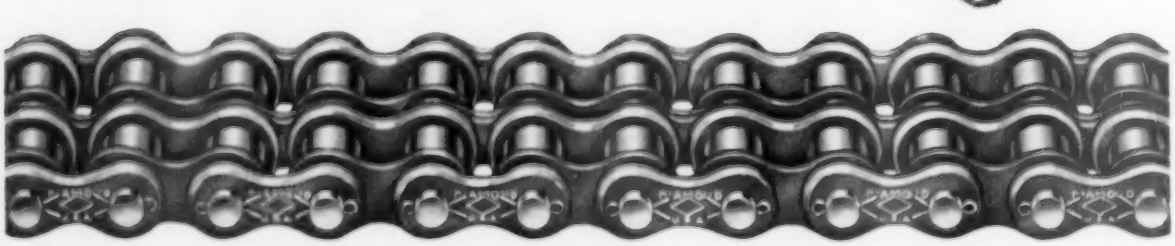
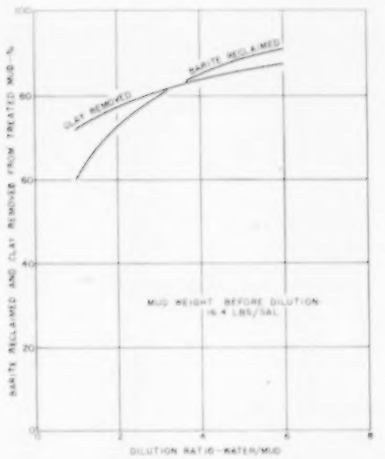
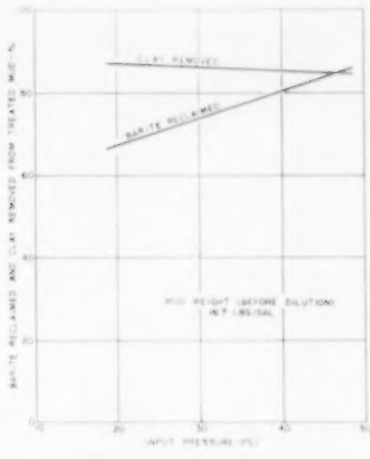
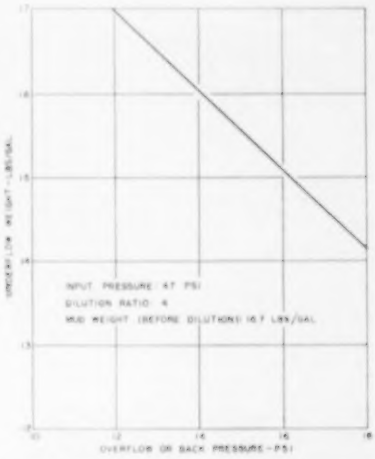




DILUTION of mud with water improves cyclone separation efficiency. Fig. 5.



FEED PRESSURE rise increases barite recovery but accelerates wear. Fig. 6.



BACK PRESSURE on overflow increased barite recovery but decreased density of underflow. Fig. 7.

DRILLING . . . *METHODS*

increased from $37.20 to $74.00. These results indicate that a 3-in. cyclone may be used to reject clay and reclaim barite from weighted drilling fluids and that the higher the dilution ratio the more efficient the rejection of clay and recovery of barite.

Effect of input pressure . . . Examples 7 to 9 in Table 1 show the effect of increasing the input pressure when treating a Gulf Coast lime-base mud with a 3-in. cyclone while maintaining an underflow mud weight approximately equal to that of the original mud and using a water-mud dilution ratio of 4.

As the input pressure increased from 20 to 47 psi., the percentage of clay removed decreased only slightly but the barite lost for each 1 per cent reduction of clay in the entire system decreased from 15.9 to 8.2 sacks. The barite reclaimed from the treated mud increased from 67.5 to 84.5 per cent. Graphic results are shown in Fig. 6.

At higher input pressures the same trend was observed but there was evidence of accelerated wear of the feed orifice and liner.

Effect of overflow pressure . . . Examples 10 to 13 in Table 1 show the effect of increasing the overflow or back pressure and maintaining a constant input pressure when treating a Gulf Coast lime-base mud with a 3-in. cyclone at a constant dilution ratio of 4. As back pressure increased from 12 to 18 psi., the underflow density decreased from 17.0 lb. per gal. to 14.1 lb. per gal. The effect of back pressure on underflow weight is shown in Fig. 7.

As back pressure increased, the percentage of barite recovered for each 1 per cent reduction of clay in the entire system increased from 75.3 to 82.4 per cent. By adjusting the back-pressure valve, the underflow mud could be varied in weight from a value as low as the weight of the input mud to a value higher than 18.0 lb. per gal.

The higher efficiency obtained by having an underflow mud weighing less than the undiluted input mud would probably be offset in field operations by the need for having to add barite to the system continuously to maintain a constant weight of mud in the system.

Examples 17 to 20 in Table 1 also show the effect of increasing the back pressure except that a lime-base mud prepared in the laboratory was used for testing.

The trends observed in these tests were the same as in Examples 10 to 13. As much as 95 per cent of the clay was removed from the treated mud.

Effect of no dilution . . . Examples 14 and 15 in Table 1 show the effects of passing undiluted mud through a 3-in. cyclone. With a gel-chemical mud prepared in the laboratory weighing 12.3 lb. per gal. and with the overflow valve adjusted so as to produce a sludge at the underflow weighing more than 18 lb. per gal. barite savings by cyclone treatment were 58.2 per cent. In this type of operation in the field, a small stream of water would have to be added to the pits continuously to keep the mud weight from increasing.

Cyclone treatment of an undiluted laboratory lime-base mud weighing 16.8 lb. per gal. was not as efficient. A savings in barite as compared to jetting was only 19.6 per cent. These results indicated that mud weighing in the range of 12 to 13 lb. per gal. may be treated economically with the cyclone without dilution by maintaining a high-density overflow.

Comparison of cyclone sizes . . . Examples 21 to 26 in Table 1 show the comparative efficiency of 8-in. and 3-in. cyclones for treating a drilling fluid to reject clay and reclaim barite. Treatment of a gel-chemical mud diluted with 0.5 parts water resulted in a barite saving of 2.6 per cent with the 8-in. cone and 15.2 per cent with the 3-in. cone as compared to jetting. When using a dilution ratio of 3.34, the 8-in. cone saved 15.2 per cent barite and the 3-in. cone saved 59.6 per cent barite as compared to jetting.

These results indicate that a 3-in. cyclone is more efficient than an 8-in. cyclone for recovering barite and rejecting clay.

High-temperature gelation . . . To test the effects of cyclone treatment on high-temperature gelation, a lime-base mud from the Louisiana Gulf Coast weighing 16.8 lb. per gal. and containing approximately 70 lb. of clay per barrel was used. A portion of the mud diluted with 2.5 parts water was pumped through a 3-in. cyclone at an input

TABLE 2—EFFECT ON HIGH TEMPERATURE GELATION PROPERTIES OF MUD BY TREATMENT WITH 3-IN. CYCLONE

(Samples cured 16 hours at 300° F.)

Sample No.	Sample composition—	Viscosity (cp.)	Shear strength (lb./100 sq. ft.)
1	Neat mud (high clay content, field lime-base mud)	300	4,200
2	8 parts neat mud, 1.2 parts cyclone underflow	180	1,000
3	5 parts neat mud, 3 parts cyclone underflow	96	190
4	5 parts neat mud, 3 parts cyclone underflow, 2 parts barite and water	60	80

pressure of 46 psi., and an overflow pressure of 14 psi., so as to provide an underflow weighing 16.8 lb. per gal. Samples of the undiluted mud and the cyclone underflow were cured for 16 hours at a temperature of 300° F. in pressure vessels. After curing, the viscosity and gel strength of the samples were measured.

The effects of cyclone treatment on gelation properties of the drilling mud are shown in Table 2. The untreated mud had a shear strength of 4,200 lb. per 100 sq. ft. after aging 16 hours at 300° F. Treatment of 20 per cent of the mud to remove clay reduced the shear strength to 1,000 lb. per 100 sq. ft., or approximately 75 per cent, even before water and barite were added to replenish the volume lost by cyclone treatment. Treatment of one-half of the mud to remove clay reduced the shear strength to 190 lb. per 100 sq. ft. and when the volume was replenished with barite and water, the shear strength was lowered to 80 lb. per 100 sq. ft. These results indicate that a 3-in. cyclone may be used to reduce high-temperature gelation of drilling fluids by lowering the concentration of clay.

Lost-circulation materials . . . Results of tests showing the effect of cyclone treatment on the concentration of finely ground lost-circulation materials such as walnut shells, mica, and cellophane flakes appear in Table 3. The results show that most of these lost-circulation materials may be recovered in the underflow if the overflow mud has a weight of less than 9.0 lb. per gal.

The 3-in. cyclone with a ¼-in.-diameter underflow orifice was not found satisfactory for treating drilling fluids containing coarse lost-circulation materials, such as coarse walnut shell, perlite, and cottonseed hull, because of a tendency for these materials to plug the underflow orifice. Similarly, large cuttings, such as might accumulate in the mud when bypassing the shale shaker, tend to plug the ¼-in.-diameter underflow orifice of a 3-in. cyclone. Three inch cyclones containing ½-in.-diameter underflow orifices operated satisfactorily but with less efficiency when treating drilling muds containing coarse lost-circulation materials.

Treatment of drilling muds with an 8-in. cyclone to remove large cuttings and retain coarse lost-circulation materials will be discussed in Part 2.

Field Tests

Field tests have been conducted with a manifold of 3-in. cyclones on two wells in the Texas-Louisiana Gulf Coast. On the first well in Big Lake field, Louisiana, the cyclones were used to combat high viscosity and maintain constant density by rejecting clay and reclaiming barite. On the second well, near Buras, Louisiana, the cyclones were used to convert a high-pH lime-base mud to a low-solids, low-pH, phosphate-CMC (sodium carboxymethyl cellulose) mud by removing the clay and chemicals and reclaiming the barite.

A CMC-caustic-quebracho, weighted drilling mud was used on the Big Lake well. Because of the large number of feet drilled each day and the fact that no protective string had been set in the well, the viscosity of the mud had become impossible to control unless large quantities of water and chemicals were added continuously while drilling. The viscosity of the mud return while drilling measured as high as 150 seconds and after trips the viscosity was often too high to measure. Daily treatment of 200 to 400 sacks of barite, 200 to 600 lb. of chemicals, and 100 lb. of CMC at a cost of $500 to $950 was required to keep the viscosity down and maintain a weight of 12.4 lb. per gal.

A manifold of ten 3-in. cyclones was suspended across a mud pit. Two of the cones were blocked off since a satisfactory treatment rate was obtained with eight cones.

After the cyclones were placed in operation, the consumption of barite was eliminated and the mud viscosity was maintained at 60 seconds without chemical treatment. The cyclones were also used to reclaim barite from the reserve pit.

Treating method . . . No operational difficulties were experienced with either the pumps or engines. The water and mud flowed together in a tee 20 ft. from the cyclones. At an input pressure of 50 psi., three to four parts water to one part mud were pumped into the cyclones. The mud in the pit weighed 12.5 lb. per gal. The back pressure of the cyclones was adjusted to about 14 psi. by means of a pinch valve so as to produce a mud at the underflow weighing 12.8 lb. per gal. Water and diesel oil were added in a small continuous stream to compensate for the slightly higher weight of the underflow mud. The overflow mud weighed 8.6 lb. per gal.

Settling tests with the overflow mud indicated that only 5 per cent of the barite was lost. Further indication that the loss was small was the fact that the level of the mud in the pit remained unchanged after 5 hours of cyclone treatment. With eight cyclones operating, the mud was treated at a rate of approximately 30 bbl. per hour.

For short periods of time, the cyclones were operated with a dilution ratio of 1. At this ratio, the overflow or reject mud weighed more than 9 lb. per gal., indicating loss of barite. A drop of the mud level in the pit verified a loss of barite.

The cyclones were employed twice to recover a total of approximately 300 sacks of barite from the reserve pit. The only change required in the setup was to place the suction of the cen-

TABLE 3—EFFECT OF CYCLONE TREATMENT ON CONCENTRATION OF FINELY GROUND LOST-CIRCULATION MATERIALS IN DRILLING MUD

	Lost-circulation material			Mud wt.	Overflow			Underflow			
Type mud:	Type	Conc. lb./bbl.	Dilution ratio	diluted, lb./gal.	Rate (g.p.m.)	Weight (lb./gal.)	L.C.M. (lb./bbl.)	Rate (g.p.m.)	Weight (lb./gal.)	L.C.M. (lb./bbl.)	Percentage L.C.M. in underflow
A	Walnut shells (−30+100 mesh)	14	5.85	10	9.05	9.05	.045	1.32	17.2	13.0	81
A	Walnut shells (−30+100 mesh)	14	5.85	10	7.5	8.95	Trace	1.97	15.1	13.85	99
B	Walnut shells	2	1.84	11.0	7.15	9.75		2.61	16.1		0 walnut shells 99 mica 60 cellophane
	Mica	3									
	Cellophane	1									
B	Walnut shells	2	5	9.6	8.7	9.0		1.29	16.4		10 walnut shells 99 mica 90 cellophane
	Mica	3									
	Cellophane	1									
B	Walnut shells	2	5	9.6	7.6	8.8		1.67	14.8		99 walnut shells 99 mica 95 cellophane
	Mica	3									
	Cellophane	1									

A—Lime-base mud: weight, 16.8 lb. per gal.; viscosity, 90 cp. B—Gel chemical: weight, 15.9 lb. per gal.; viscosity, 89 cp.

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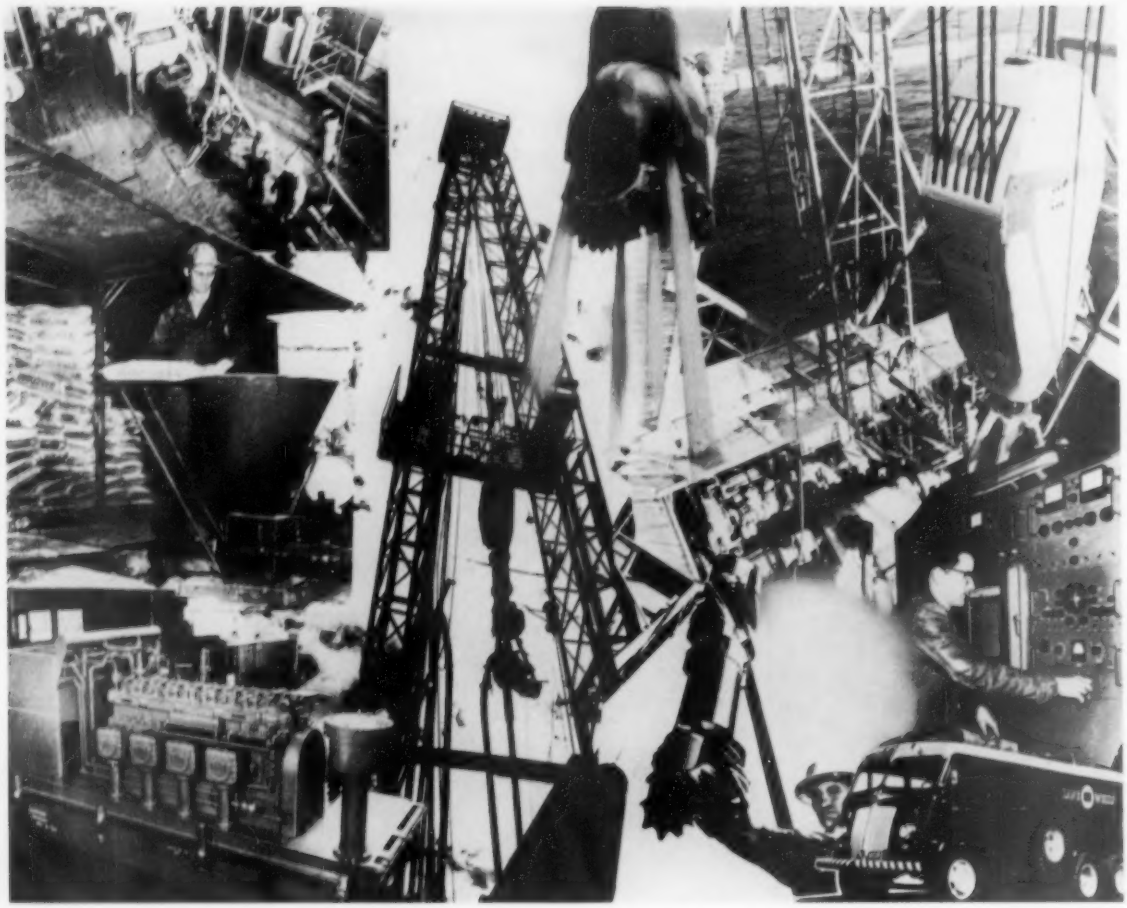

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Thredkote 701 is one of a complete line of quality thread compounds. There's one for almost every type of threaded connection.

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Houston 1, Texas

HUMBLE

"Other than for filling the fuel tanks on the pump engines and occasionally checking the mud weight, the cyclones ran unattended."

trifugal mud pump into the reserve pit and to return any unused mud through a bypass line to the reserve pit.

Savings . . . The estimated savings in barite and chemicals effected by the use of eight cyclones for 14 days operating an average of 4 hours per day, amounted to a value of $8,700 which was $2,700 more than the total cost of the cyclones and the two pumps and diesel engines feeding the cyclones. This is the saving above the cost of the diesel oil lost from the mud passed through the cyclones.

The results of the field test indicate that 3-in. cyclones will recover as much as 95 per cent of the barite while rejecting clay from diluted drilling fluid. Eight cyclones operating approximately 4 hours per day can maintain a constant mud viscosity with a large savings in barite. When treating diluted mud with 3-in. cyclones, most of the diesel oil and chemicals in the mud passing through the cyclones are lost in the overflow; however, no more oil and chemicals are lost for each pound of clay removed by cyclone treatment than would be by jetting.

West Bastian Bay . . . Ten 3-in. cyclones were used on a well in West Bastian Bay, Louisiana, to maintain a low-solids mud and to convert the mud from a high pH lime-base mud to a low-pH phosphate-CMC mud.

While cutting a window in the casing at a depth of 11,941 ft., a decision was made to convert to a low-pH mud because of hole difficulties which had been experienced with the high-pH mud. Discarding the old mud and mixing new mud would have cost about $11,000. To save this cost the cyclones were used to reject the chemicals and clay and reclaim the barite. The cyclones were operated for approximately 40 hours during the 3-day period. Mud weight was maintained at 14.5-lb per gal.

As the clay solids and chemicals were rejected from the mud, $640 worth of CMC and gel were added to keep the barite in suspension. When the entire system had passed through the cyclones with a loss of 180 bbl. of mud, treatment ceased.

Tests showed that the lime content had been reduced to negligible concentration although the pH was 12.5. Approximately 95 per cent of the finely ground walnut shell carried in the mud was recovered at the cyclone underflow with the reclaimed barite.

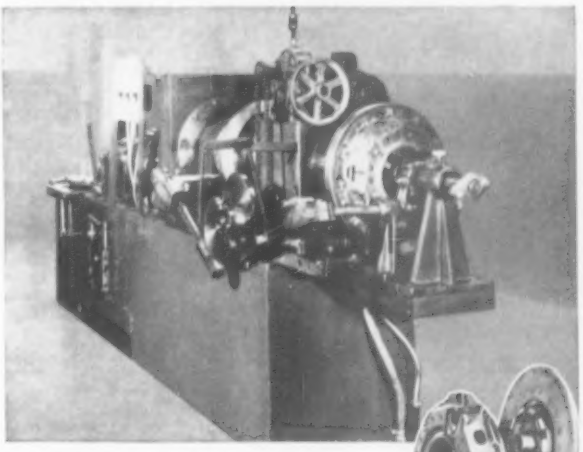
After the window was cut and drilling continued, the cyclones were again placed in operation a few hours daily. The pH of the mud was gradually lowered to below 11.0 without treatment other than with the cyclones.

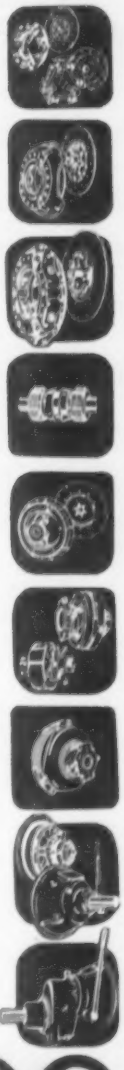
The highest portion of the 180 bbl. of mud lost to the overflow during cyclone treatment was lost because of insufficient dilution of the mud passing through the cyclones during the first 2 days of operation. On the third day, using a dilution ratio of three parts water to one part mud, the cyclones were operated continuously for 12 hours with a loss of only 20 bbl. of mud. Other than for filling the fuel tanks on the pump engines and occasionally checking the mud weight, the cyclones ran unattended.

Savings . . . Subtracting the estimated cost of gel, clay, CMC, and diesel oil, approximately $10,000 were saved by converting the mud with the cyclones.

Manifolds of 3-in. cyclones are currently being used as a routine method of economically treating weighted drilling fluids. Manifolds of larger cyclones are also being used to reject cuttings and sand from low-weight drilling fluids.

ROCKFORD





Thoroughly Tests ROCKFORD CLUTCH Facing Materials

To record the durability and heat resistance of current and newly developed friction material, for ROCKFORD CLUTCHES, two driven-member assemblies are assembled with two flywheels and clutch cover assemblies.
The automatic rotating cams of the engaging device produce repetitive engaging and disengaging cycles of the driving clutch and braking clutch assemblies. 10,000 engagements and disengagements, four cycles per minute, give a very conclusive wear test on the friction facings. The repetition and standardization of this test procedure constitute an accurate analysis of the wearing quality of friction facing materials used in ROCKFORD CLUTCHES.
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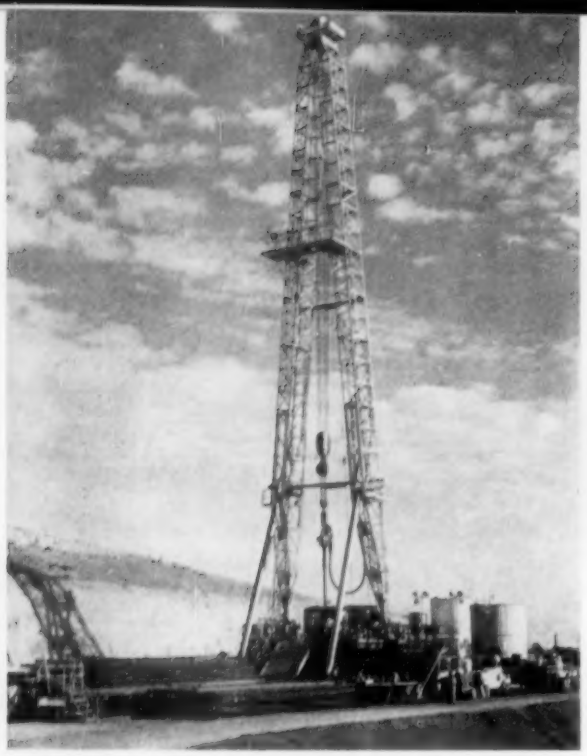
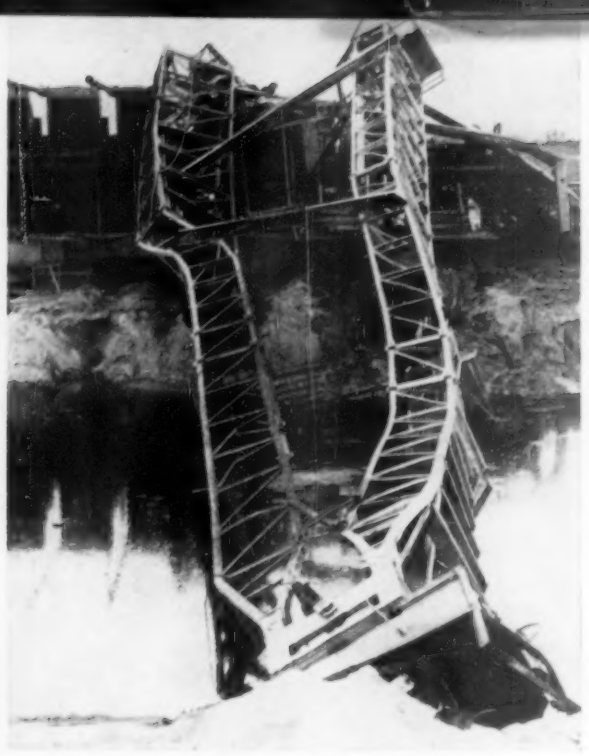
CLUTCHES





Act safely and everything's OK. . . but overlook something and end up with this. Here's a

Check List for Moving Full-View Mast

by Donald G. Quinn

DRILLING . . . *METHODS*

OPERATING the full-view mast can be a dangerous procedure without proper instructions and supervision. Many accidents have resulted from raising and lowering these masts in the past. Perhaps 95 per cent of them have been due to human failure while only the remaining 5 per cent were caused by mechanical failures.

Because moving, raising, and lowering the full-view mast is such a critical operation, the importance of instructions, check list, and supervision must be stressed.

Ideco builds these different sizes of full-view masts. The 133-ft. and the 138-ft. masts are identical except for a 5-ft. section which is added to provide additional height for 138-ft. mast.

These two masts have a rated static hook load of 400,000 lb. with eight lines; while the heavy-143-ft. mast has a rated static hook load capacity of 650,000 lb. These masts require the same raising, lowering, and moving instructions (see Fig. 1).

Author is with Shell Oil Co., Los Angeles. Paper presented at Western Oil and Gas Association regional safety conference, Long Beach, Calif.

Follow list . . . In a normal rig-move job, the first step in handling the mast is to lower it. This unique job requires special attention and it is important that the raising and lowering instructions and check list be followed in every detail. Too many operators have tried to rely on their memories instead of the written instructions and many accidents have resulted.

Because this operation is so infrequently done and usually by a different crew, it is important to use the instruction check list. Crews may raise and lower a mast a dozen times or more without instructions and have no trouble, but sooner or later, they will overlook something that may result in a dangerous and costly accident.

After the mast is down, the lines are removed or stored in place and the mast is prepared for moving. To be moved legally along the highway, it will have to be broken down to three truck loads. When making a move within a lease, it is not required to break down the mast. It can be moved in one package or by removing the two lower legs and moving the top section as a single package.

Make it safe . . . Moving the mast can be illustrated by pictures. One other very important part is the danger of taking the mast apart while it is lying on the headrest. When disassembling the mast, the men working on top are from 12 to 16 ft. above the ground, making this operation a little more difficult. When breaking the mast down in legal packages, the mast should be broken in half, with the upper half of the mast on the ground so it can be disassembled safely.

Another very important safety measure is tying on to the mast to pick it up. When using one crane to handle the mast, it should be handled differently than when using two cranes. In handling the mast with one crane, a special lifting device should be made to pick it up safely without bending or springing it. Every time a part like the main angle-iron member is bent, more weight is thrown on another section of the mast. When any part of the mast is bent or damaged, it should be repaired immediately, regardless of how unimportant it may look. Every small brace, as well as every large one, has a very important job.

MAST-RAISING CHECK LIST

1. Mast must be in a level position or above when supported on head rest.

2. Make final visual inspection of mast, checking carefully the following:

(a) Raising line string up (make sure all lines are in raising sheave groove and clear).

(b) Condition of raising sheaves.

(c) Dead-line anchor connection.

(d) Back braces properly attached to mast pedestal and bolts and pins in raising legs in place.

(e) Check the amount of line on drum and make sure there is enough line to prevent dropping blocks. (Minimum number of wraps needed should be on metal plate attached to the draw works.)

(f) Back struts bolted and safety lines in place.

(g) Racking platform properly attached.

(h) Crown warning switch properly attached.

(i) Inspect both legs and guide rails for loose material.

3. Make a visual inspection of the locking cams (both sides) to see that they are in full open position (see Fig. 1).

4. Lubricate all bearing points in mast.

5. To prevent traveling blocks from fouling hinged platform on racking board during raising, tie back hinged platform to racking platform handrail.

6. Make sure derrickman's safety line is properly attached.

7. Make sure everybody is clear.

8. Make sure weight indicator is working properly.

9. Place hoist drum in lowest speed and slowly increase pull on lines. If mast does not start up with 130,000 to 150,000 lb. pull for 143-ft. mast (115,000 to 130,000-lb. pull for 138-ft. mast) recheck weight indicator and rigging.

10. Raise mast slowly into vertical position and observe action of locking cams as mast approaches vertical.

11. After mast is in vertical position, pull approximately 30,000 lb. on hook and lock brake.

12. Insert lock jacks in each mast section, paying particular attention to note that the tapered face on the end of the jacks bear against the locking cam (see Fig. 1).

13. When lowering blocks watch drum to make sure enough line is on the drum to prevent blocks from dropping.

14. Store raising slings in mast legs.

15. Check dead-line stabilizers and adjust as necessary to eliminate excessive bends in dead line.

Mast-Lowering Check List

1. Attach raising sling lines to yoke and connect to traveling block's hook. Check to eliminate kinks in raising lines.

2. Check condition of raising sheaves.

3. Check bolts and pins in raising legs and supports from bottom of derrick legs to subbase.

4. To prevent traveling blocks from fouling, swing platform on racking board up and tie to racking platform handrail.

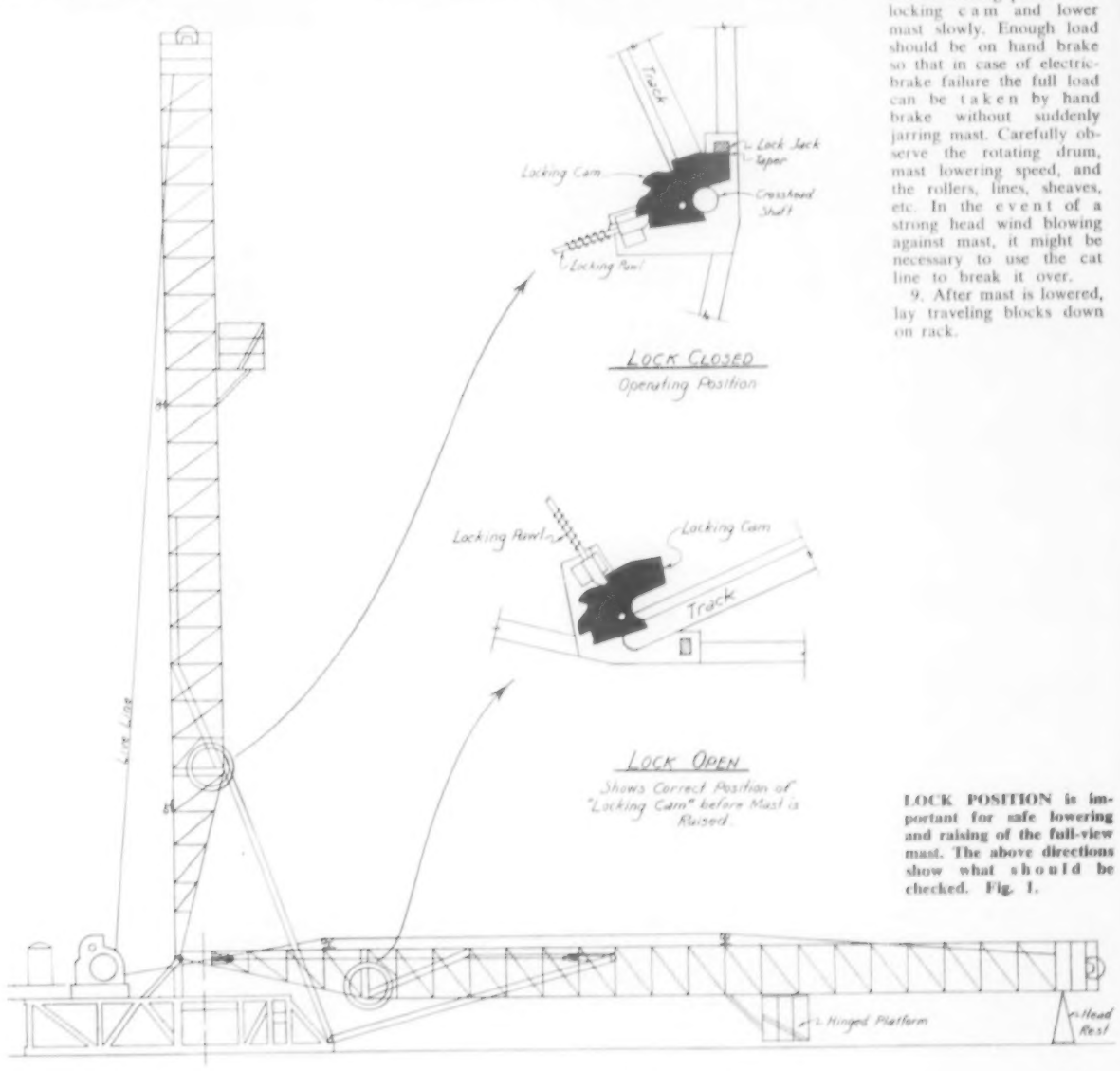
5. Be sure weight indicator is working properly, and hand brake and electric brake are in condition to handle expected loads.

6. Take approximately 30,000-lb. pull on hook, lock brake and remove safety locking jacks (see Fig. 1).

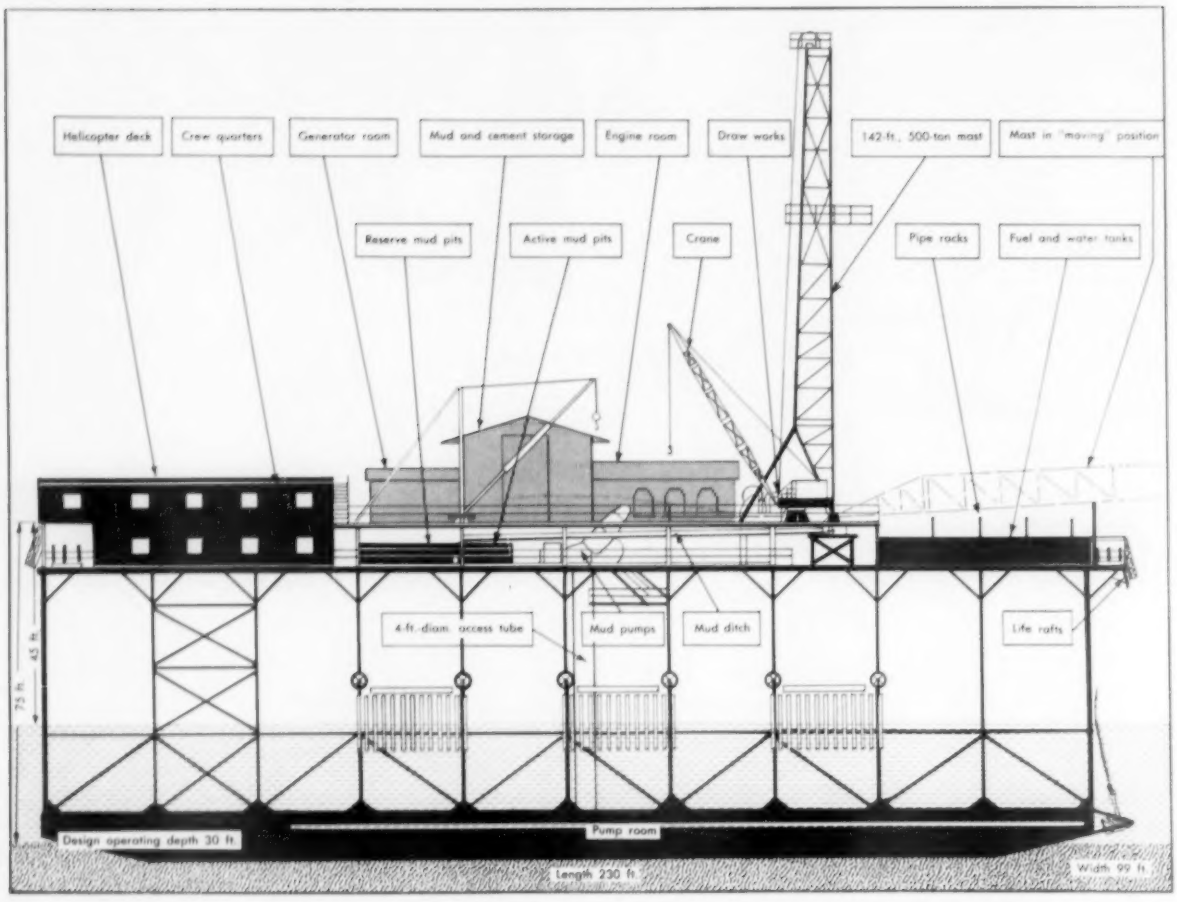
7. After removing safety jacks from mast legs, hinge platform back and tie.

8. Pull latch release ropes from floor to release locking pawls from locking cam and lower mast slowly. Enough load should be on hand brake so that in case of electric-brake failure the full load can be taken by hand brake without suddenly jarring mast. Carefully observe the rotating drum, mast lowering speed, and the rollers, lines, sheaves, etc. In the event of a strong head wind blowing against mast, it might be necessary to use the cat line to break it over.

9. After mast is lowered, lay traveling blocks down on rack.



LOCK POSITION is important for safe lowering and raising of the full-view mast. The above directions show what should be checked. Fig. 1.

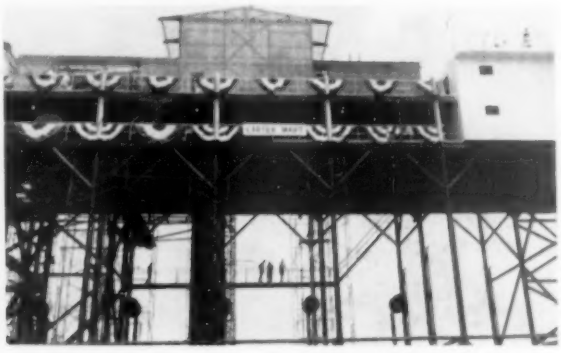


THE CARTER MART and its equipment. This drilling barge, also shown in the photo below, can put 2,400 hp. into its draw works. Fig. 1.

DRILLING . . . *EQUIPMENT*

New mobile platform lays claim to

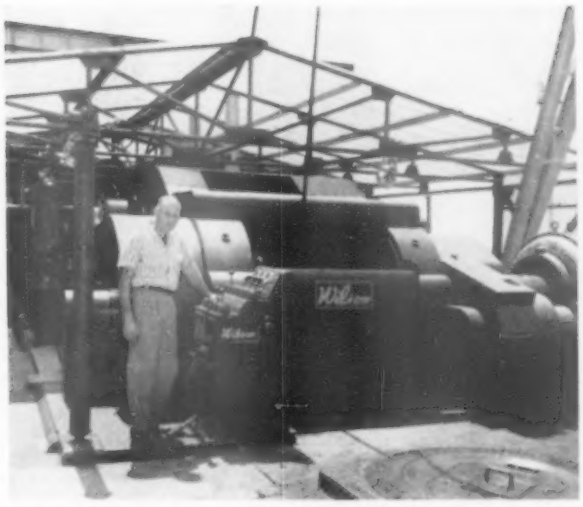
Most Powerful Rig Ever Built



Morris & Hamilton, Inc.'s new mobile offshore-drilling platform lays claim to having the most powerful rig ever built. There is 2,400 hp. in the three drilling engines that drive the draw works and two main mud pumps. Independent drives for rotary and mud-mixing pump boost the total to 3,600 hp. This powerful rig can match any past drilling performance; it should be able to drill to the greater depths that will be seen in the next several years. Morris & Hamilton's rig is proof of the contractor's—and the drilling industry's—determination to be ready for the demands of tomorrow's deep-oil search.

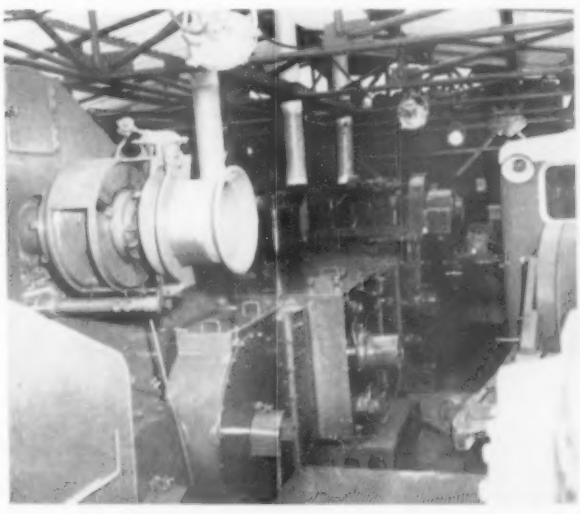
by Ed McGhee
District Editor

SO far as is known, the rig on Morris & Hamilton, Inc.'s, new mobile drilling platform, the Carter Mart, is the world's most powerful. It has 2,400 hp. available to the draw works. Three 800-hp. diesel engines drive the rig and two 1,000-hp. pumps through a chain compound. Moreover, there is another

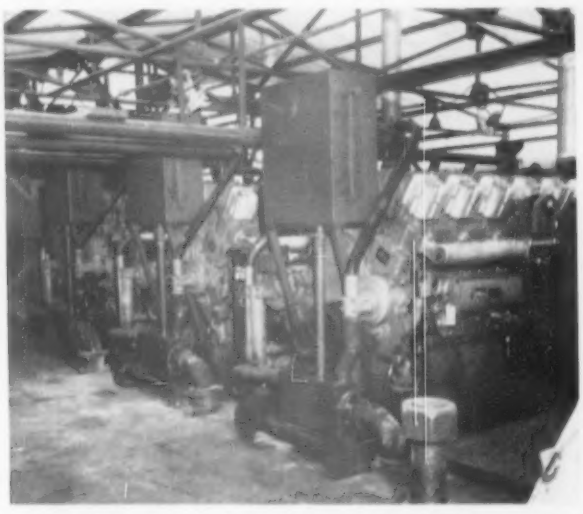


ALTHOUGH the draw works is claimed to be the largest ever built, controls for it are simple and easily worked. Clutches are on the outside of the frame. Fig. 2.

DRIVE for the rotary table is independent of draw-works drive. Rotary-drive engine is a diesel rated at 400 hp. intermittent and 280 hp. continuous. Fig. 3.



CHAIN COMPOUND that couples the three drilling engines to the big draw works. It is designed for easy access to make repairs fast. Fig. 4.



EACH of these three drilling engines is rated at 800 hp. intermittent. They drive not only the draw works but also two 1,000-hp. mud pumps. Fig. 5.

1,200 hp. in the independent drives to the rotary and mud-mixing pump.

Not only does the platform have a big rig, but it is arranged so that the rig has almost as much work space as does a land rig. Because it does have plenty of work space and because it is permanently mounted, the rig is probably more easily maintained and more reliable than a land rig of the same size would be.

In drawing up original plans, Morris & Hamilton tried to design the platform around the rig so that the individual pieces of equipment would fall in their natural places. As a result, the rig is able to use a short, conventional mechanical drive to both draw works and pumps. All equipment is easily accessible for maintenance, repair, and replacement. There is no necessity for a complicated control system to tie in distant pieces of equipment.

Double-drum draw works . . . The Carter Mart's draw works is a double-drum Wilson Super Titan "66," the first of its kind ever built. It can drill to 20,000 ft. with 4½-in. drill pipe or to 25,000 ft. with 3½-in. pipe.

The rig keeps a low ratio between speeds so that shifting into the next higher speed is fast. Each speed is just 40 per cent faster than the next slowest. Over-all, the highest speed is only 5.6 times the lowest. Yet, the highest speed is enough to take the empty blocks up as fast as needed; and the lowest has enough power to hoist the greatest loads easily.

If one engine goes out of service when under extremely heavy load, a smaller low-speed drive sprocket can be substituted into the drive. This requires only a few minutes and operations can go on normally with only two engines.

Both the drum drives and the clutches are on the outside of the draw works frame so that they are easily accessible for repair or maintenance. All clutches are air-tube disk friction clutches.

The main drum is grooved and carries 1⅜-in. drilling line. The core reel spools 18,700 ft. of ⅞-in. line or 15,200 ft. of ⅝-in. line.

A new braking system on the rig prevents the hand lever from kicking

REPORTS OF PERFORMANCE

from users during the past 16 years show that Kennametal* lasts 20 times longer than steel and 3 to 5 times longer than special and super alloys.

• A Texas producer reported sand abrasion forced a pulling job every 14 to 20 days. After 448 days on the job, Kennametal Balls and Seats showed no wear when well was pulled for other than valve job.

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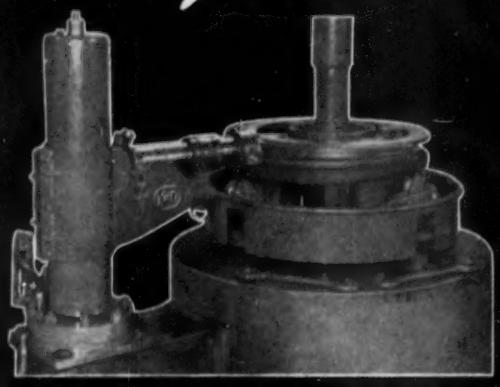
...Partners in Progress

Kennametal API Balls and Seats are available at repair shops of most major pump manufacturers. Ask your service man to standardize on them. They'll cost you less in the long run. KENNAMETAL INC., Latrobe, Pennsylvania.

*Kennametal is the Registered Trademark of a series of hard carbide alloys of tungsten, tungsten-titanium and tantalum.

THESE ARE THE *Facts* ABOUT KELCO AIR OPERATED POWER SLIPS



Compare!

- Only 5# lift — several times lower than on any other slips. Eliminates elevator follow down while setting.
- Exceptionally long life dies.
- Four slips, individually hung, move straight into pipe without radial drag as found with clustered slips.
- From 2" tubing through 7" casing.
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- Patented safety latch absolutely prevents slip setting due to air failure — operates continuously.
- More crew safety.
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TUBING TONGS • SAFETY "C" POLISHED ROD CLAMPS

EXPORT REPRESENTATIVE—Val R. Wittich, 30 Rockefeller Plaza, New York, N.Y.

and causing injury to the driller. Brake rings themselves are 63 in. in diameter and 10½ in. wide.

The mast is a 142-ft. Lee C. Moore; it, the blocks, and swivel and hook have a 500-ton capacity.

Two tail pumps . . . Main mud pumps on Carter Mart's rig have input power of 1,000 hp. (D-1000 Emsco's). These are on the deck below the draw-works level and are driven by chain drives off the rear of the engine compound.

The engines themselves are Waukesha VLRDBU diesels. They are V-12's with 8½-in. bore and 8½-in. stroke; total displacement is 5,788 cu. in. These four-cycle engines are rated at 800 hp.

The mud-mixing pump is driven independently by a GMC 671 twin engine. This two-cycle engine can operate separately on either bank of cylinders when declutched. In this way, one bank may be repaired while the other is in operation at reduced power. Continuous rating is 280 hp. and maximum is 400 hp. This same type of twin engine drives the 27½-in. rotary independently and two more each drive 175-kw. a.c. generators for auxiliary power.

Mud equipment is concentrated on the lower deck, below and behind the draw works. There are two active steel tanks of 600-bbl. capacity and two reserve tanks of the same capacity. On the same level as the draw works, the Carter Mart has three 1,000-sack bulk-mud hoppers and one 1,000-sack cement hopper.

The Platform

Design of the platform is by Christenson & Graham, Inc., consulting engineers of Pasadena, Tex.; construction was in the Greens Bayou yard of Sprague Welding & Machine Works. In building, the basic hull was constructed first and the upper decks built directly on top of it. Then, the fixed columns were put in place on the hull and the upper decks jacked up these columns to their final position.

In the middle of the basic hull there is a pump room which is reached from the upper structure by means of a 4-ft.-diameter watertight access tube. A 6,000-cu. ft. per minute blower supplies ventilation to this room. And, in it are two 1,500-g.p.m. ballast pumps to control sinking and raising of the barge. Besides, there is a fresh-water transfer pump, standby cooling-water pump, fire pumps, two fuel-oil transfer pumps, and one sump pump.

The upper decks are 10 ft. apart, making an over-all height of 75 ft. for the entire structure. Crew quarters on the rear have accommodations for 56 men. And the top of the crew-quarters building serves for helicopter landing.

Here's how one Armco Building does <u>two</u> jobs

Unique STEELOX Panel construction makes it easy to vary the inside finish to meet different needs. Warehouse space can be plain, office can be more elaborate.

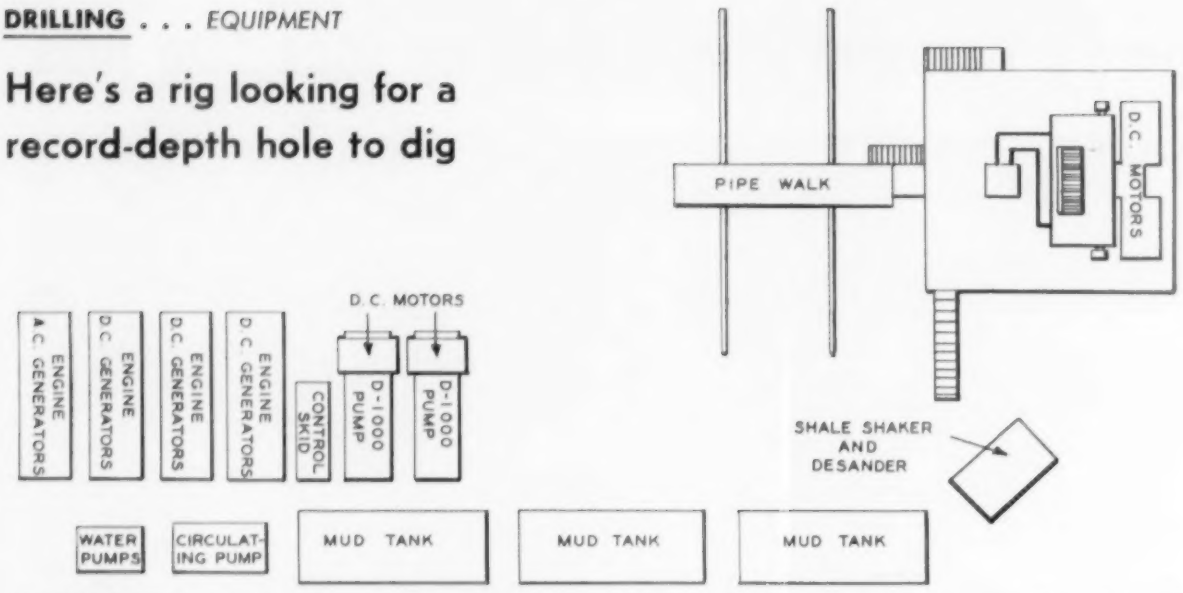
Storage and office space under the same roof. That is a requirement of many buildings in the oil country. And an Armco Steel Building provides the features that make it easy to meet those needs best. Here's how.

Interlocking STEELOX Panels provide both structural support and finished exterior. Inside, the interlocking ribs of the panels form a vertical 16-inch modular framework to which any standard insulation is readily attached and finished with plaster or drywall materials. Thus the office interior can be as elaborate as you want it. In storage, or other utility-type areas, the inside walls can be unfinished or insulated and finished as desired. An Armco Steel Building provides economical, weather-tight construction with complete flexibility of interior finish. Write us for details about Armco Buildings. There is a size and type for practically any building need. Armco Drainage & Metal Products, Inc., 4626 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

Armco Steel Buildings

ARMCO

Here's a rig looking for a record-depth hole to dig



ALL MAJOR PIECES of equipment are in skid-mounted packages so that there is little loose to handle during moves. The packages will also make easier putting the rig on a platform for offshore drilling. Fig. 1.

Circle's New Rig Has Plenty of Muscle

Circle Drilling Co. of Eunice, La., has just put to work a big, new diesel-electric rig. It's capable of drilling to any present depth with ease, yet it is not bulky nor overdesigned. It can be easily set up on land, a barge, or offshore platform. And there's no need for special technicians to rig up, operate, or maintain it.

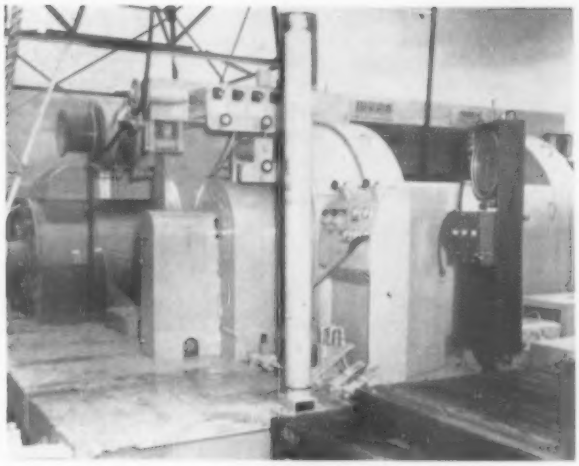
by Ed McGhee
District Editor

IN SPITE OF the powerful size of the rig, the substructure and derrick floor are uncluttered. The structure behind the mast is a radio antenna. Fig. 2.

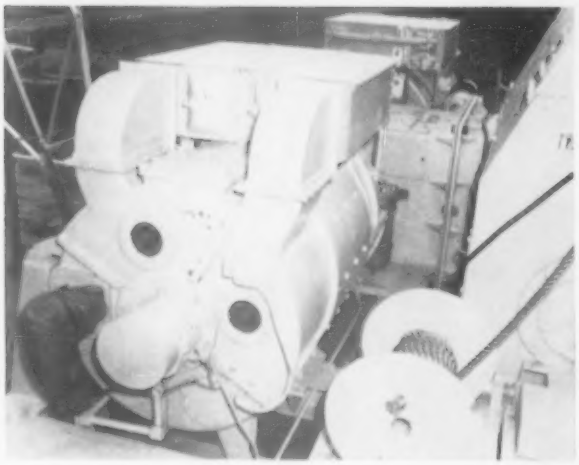
FOR the past several years, the world's deepest oil production has been in South Louisiana. For almost a year, the world's deepest drilling depth has also been in South Louisiana. These facts are proof of the power and dependability demanded of rigs that drill there.

One of the newest and most powerful of its type in South Louisiana is the rig recently put into operation by Circle Drilling Co. of Eunice, La. This rig is a diesel-electric capable of drilling to 25,000 ft. with 5-in. drill pipe. In spite of its size, the rig is simple in construction, easy to operate, and should be cheap to maintain. The electrical and mechanical design is arranged so that all of the equipment is easly accessible.

Power from three skids . . . Power for operation of the rig's major equipment comes from three engine-d.c.-generator



DRILLER'S POSITION on the big rig. Electric power makes it easy for the driller to keep all operations under his control from this point. Fig. 3.



ONE OF THE TWO d.c. motors driving the draw works (the second is immediately behind). These water-cooled motors can deliver up to 2,250 hp. Fig. 4.

DRILLING . . . *EQUIPMENT*

skids. Each skid carries a supercharged diesel engine driving two 540-kw. d.c. generators with exciters. The engines have a displacement of 5,788 cu. in. and 8½ by 8½-in. bore and stroke. They are rated at 814 continuous horsepower at 1,100 r.p.m. and at 1,020 hp. on intermittent service.

The engines have two exhaust-driven superchargers and are constant-speed full diesels. They each drive two generators each of which is connected in series with a generator alternate skids. The generators are shunt-wound and rated at 240 volts and 2,250 amp. at 1,200 r.p.m.

Three series loops make up the main electrical-power circuit—one for the draw works and one for each of the two main pumps. This arrangement is simple and flexible; it permits a minimum of control to give a maximum of horsepower selections. This is a positive-control system in that each control component can be identified easily with its function. The result is easy maintenance and operation, with no need for highly trained technicians.

Power aplenty on draw works . . . Fig. 3 shows Circle Drilling's draw works. Notice the simplicity of controls at the driller's position. This is a single-drum draw works fitted with air-actuated friction clutches.

The 27½-in. rotary is driven off the draw works through a rotary countershaft and right-angle gearbox. This shaft and gearbox is a separate package from both draw works and rotary.

Fig. 4 shows the two motors driving the draw works. These shunt-wound d.c. motors are enclosed and water-cooled. They drive into the draw works through chains. Power to the draw works is governed by a selector switch that will give these ratings:

No. 1 position — 750-1,000 hp.—power from No. 1 engine

No. 2 position — 750-1,000 hp.—power from No. 2 engine

No. 3 position—1,560 hp.—power from Nos. 1 and 2 engines

No. 4 position—2,250 hp.—power from Nos. 1, 2, and 3 engines.

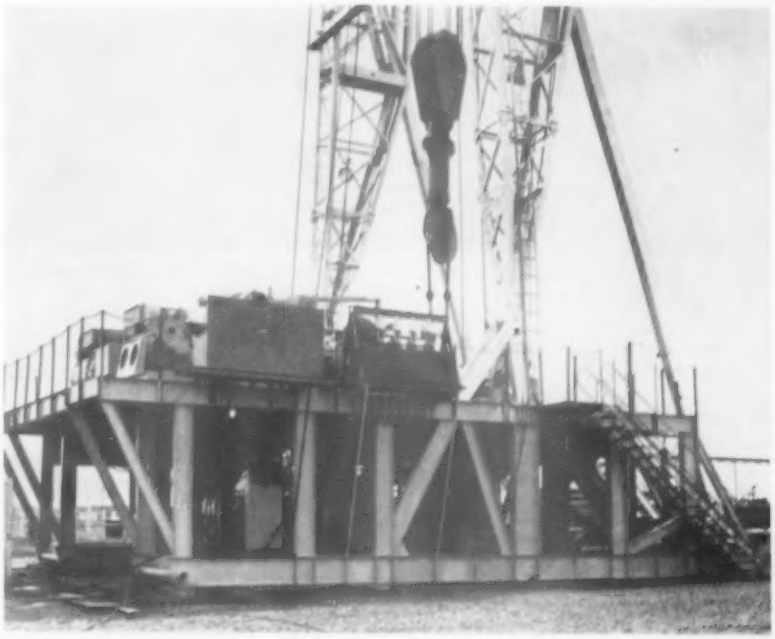
These horsepowers are continuous ratings; the actual intermittent ratings are much higher than this.

As Fig. 5 shows, the draw works and its drive do not occupy much space on the substructure. The substructure is especially designed and is joined together with pins wherever possible to make it easily assembled and torn down for moves.

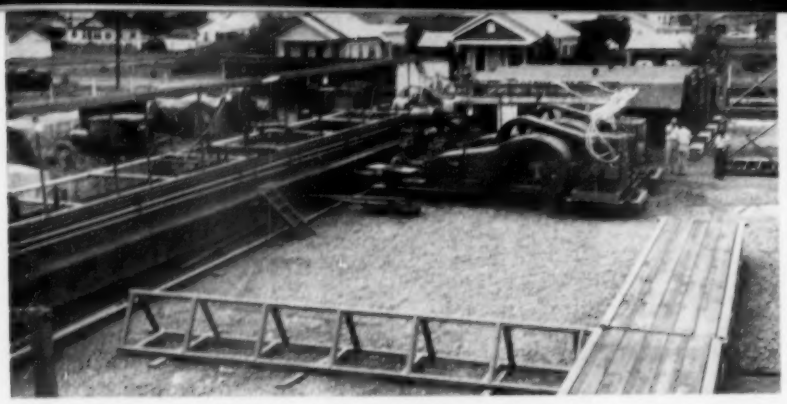
Also housed in the substructure are an air compressor as well as control panels for some of the rig's other auxiliary equipment which is driven by a.c. motors.

The mast is a 143-ft. full-view type.

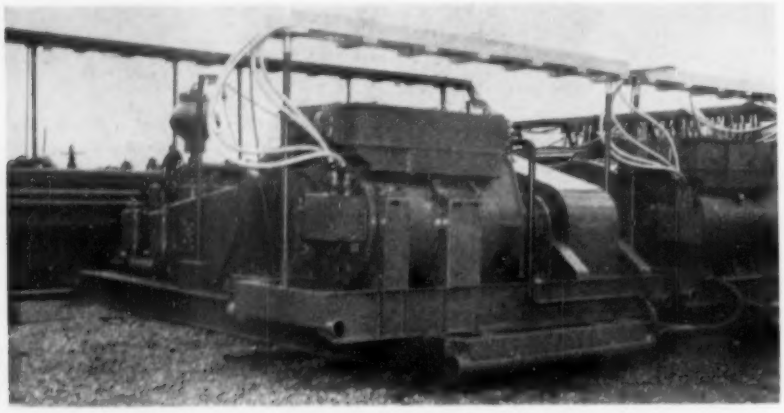
Convenient packages . . . Fig. 6 is a view from the derrick floor of most of the rig equipment. Note that the pipe racks and walkway are portable and that the mud tanks have mud and water lines unitized onto their sides just above the walkway. Notice



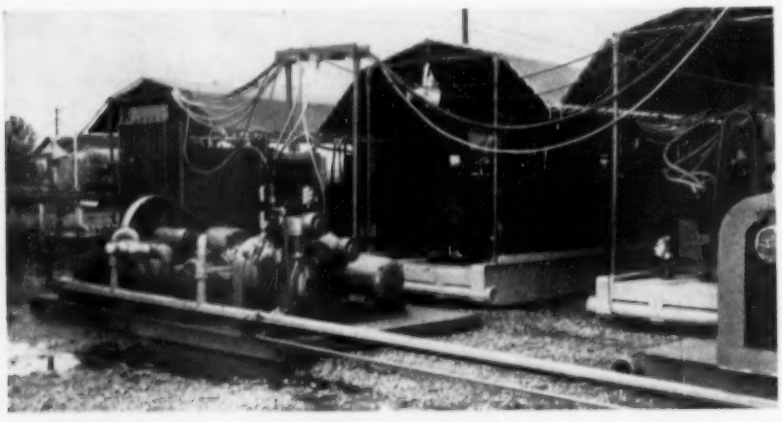
OTHER THAN THE DRAW WORKS and the mast, very little weight rests on the substructure. This will make it easy to put the rig on an offshore platform. Fig. 5.



PUMPS AND MUD TANKS. Each of the 1,000-hp. mud pumps has its own d.c. motor mounted onto the same skid with it. Fig. 6.



CONTROL for the water-cooled pump motors is on the derrick floor. Each motor may be driven at three different input powers. Fig. 7.



THE COVERED SKIDS are the a.c. and d.c. generating units. In the foreground is an auxiliary skid with water pumps and air compressors. Fig. 8.

also that the conductors for power to equipment around the derrick floor are carried in channels mounted above the tanks where they are clear of trucks, etc.

Fig. 6 shows the rig's two 1,000-hp. mud pumps. Note that the d.c. motor driving each pump is mounted onto the end of the pump skid. These motors, shown in Fig. 7 are shunt-wound enclosed, water-cooled motors. The control for these main pumps is on the derrick foor and each of them can be driven at three different input powers:

No. 1 Pump

No. 1 position—650-750 hp.—power from No. 1 engine

No. 2 position — 800-1,000 hp.—power from No. 3 engine

No. 3 position—1,000-1,300 hp.—power from Nos. 1 and 3 engines.

Pump No. 2

No. 1 position—650-750 hp.—power from No. 2 engine

No. 2 position — 800-1,000 hp.—power from No. 3 engine

No. 3 position—1,000-1,300 hp.—power from Nos. 2 and 3 engines.

Both of the pumps may be operated at the same time at the maximum horsepower of 1,000-1,200 each; and the rotary may be run along with them. The power distribution is such that all drilling operations including reaming may be carried on simultaneously. This gives real flexibility because operation is never shut down, by lack of power on any equipment.

Notice in Fig. 7 how the conductors carrying power to the pump motors are carried in channels overhead, out of the way.

Besides the two main mud pumps, Circle's new rig also has a 300-hp. pump belt driven by a 400-hp. d.c. motor.

Auxiliary packages . . . Besides the main skid-mounted packages already mentioned, the new rig has several more. One is the a.c.-generator unit which carries two diesel engines, each driving a 400-hp. generator. This 440-volt power source runs a.c. motors that drive water pumps, air compressors, and similar equipment.

There is also a pump skid that carries a 4½ by 6-in. two-cylinder water pump; two 3 by 4R centrifugal pumps; and a 5½ by 5 and 4½ by 4 air compressor. This skid is shown in Fig. 8 Each of the above pieces is driven by a 25-hp., three-phase a.c. electric motor.

Control equipment is mounted onto a central skid. The driller has control of all major equipment from his position on the derrick floor, but switchgear for these operations is located on the skid. The skid also carries two motor-driven generators for standby.

Onto platform or barge . . . Circle's new rig is designed so that it can be put onto an offshore platform or barge with little modification.

The new rig is drilling its first well —a 13,000-ft. test in the Grand Bayou area. Its performance on that well is satisfactory and there was no need for major changes in any of the equipment.

Acknowledgment

Credit is due A. F. Landers, diesel-electric consultant of New Orleans who supplied much of the information in this article and who is responsible for design of the new rig.

Major Equipment Mentioned

Engines powering generators—V-12 supercharged Waukesha diesels
Generators—Westinghouse d.c. generators with Hillman Co. exciters
Draw works—2,500-E Ideco
Rotary—Ideco
Electric draw-works motors—Elliott
Mast—143-ft. Ideco full view
Mud pumps—two D-1000 Emsco, D-300 Emsco
Pump motors—G. E.

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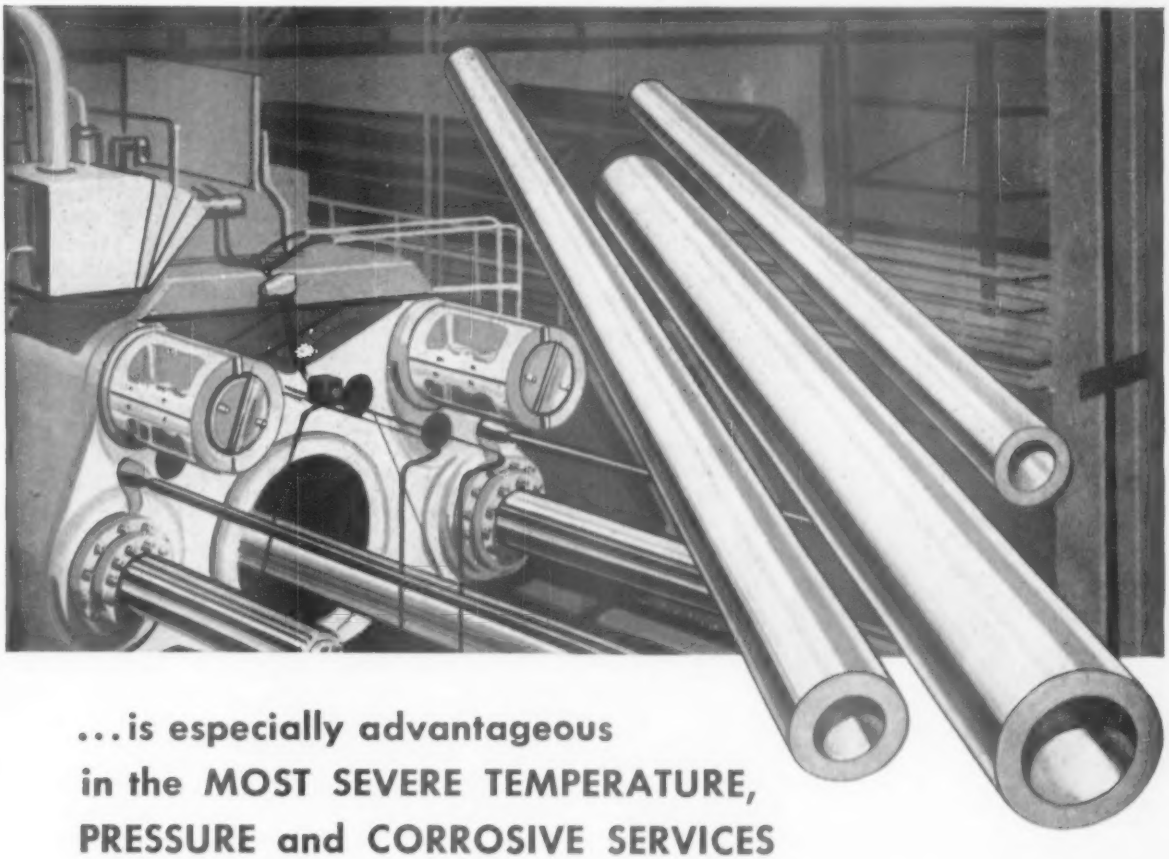

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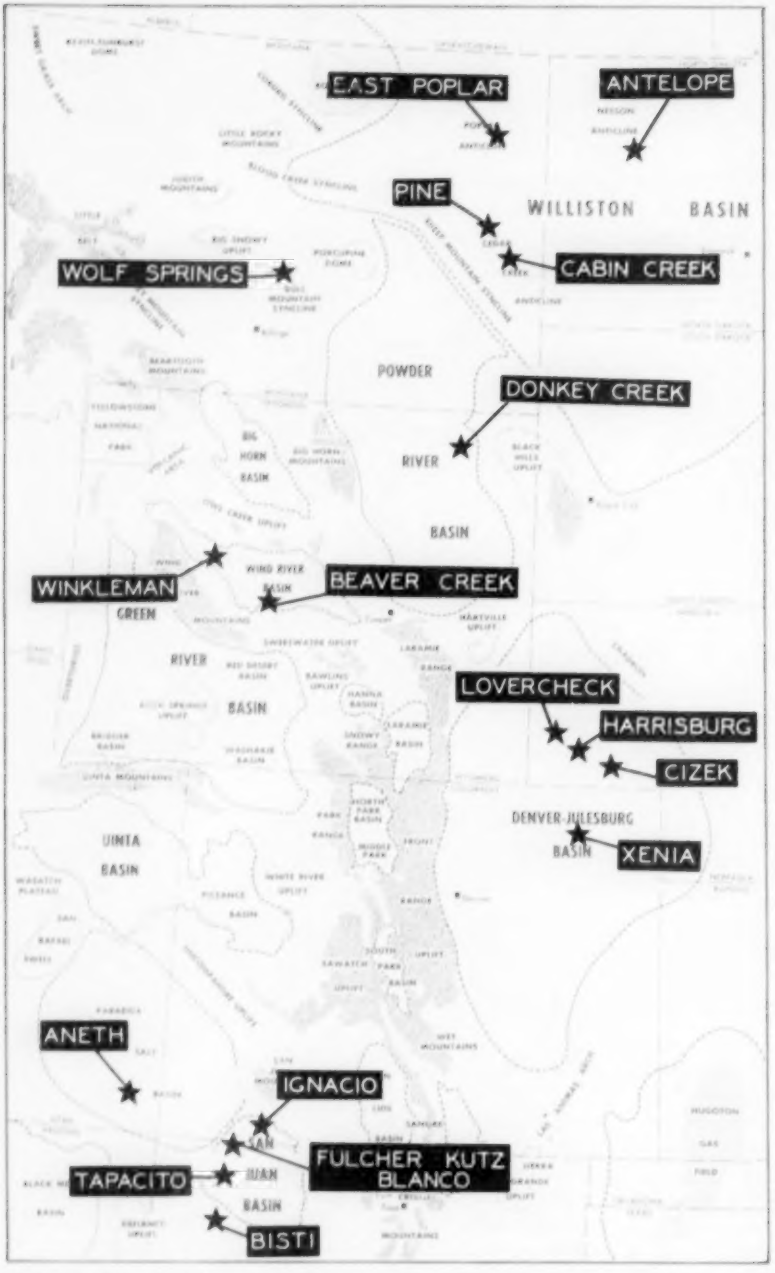

FOCAL POINT of drilling in the Rockies is the Four Corners region, but all the basins are active. Stars denote fields written up under Drilling Reports in this section.

Future Still Looks Good In the Rockies

POTENTIALLY, the Rocky Mountains offer a good future to the aggressive drilling contractor because the Rockies make up a youthful oil province. Drilling activities have been steadily climbing during the past 5 years in that region. Recent new discoveries in the Four Corners area, Central Montana, northwestern Colorado, and the Williston basin all have helped to brighten the drilling outlook during the past 12 months.

Drilling rigs in the Rockies are spread out from the San Juan basin to the Canadian border. Most of the activity is concentrated in four basins: San Juan, Denver-Julesburg, Williston, and Central Montana. Oil discoveries at Bisti in northwest New Mexico and Aneth in southeastern Utah have encouraged both exploratory and development drilling in the Four Corners area.

San Juan basin . . . Principal drilling to date has been for gas reserves. Air and gas drilling are used to complete many of these field wells. Drilling in southwestern Utah offers many problems, particularly on wildcat locations.

Invariably, wells are staked at remote locations, making repairs costly because of the distance to the nearest supply center. In addition, in parts of the area, wells drill through a considerable salt section. Washing out of the salt will cause stuck drill pipe and difficulties when running casing.

Denver-Julesburg basin . . . Drilling has slackened somewhat in the Denver-Julesburg basin. Operators are taking a closer look at the oil possibilities of this basin and this may indicate a final intensive drilling campaign is in the offing.

Williston basin . . . Discovery of an abnormally thick pay section at Antelope field has renewed interest in the Williston basin. The field lies slightly east of the main Nesson anticline and was the result of seismic work. Oil companies feel that fields similar to Antelope are present in the Williston basin and they are actively searching for them.

Drilling through the salt section in the Williston basin poses a serious problem, both during drilling operations and later from a production standpoint. Several instances have been recorded of collapsed casing caused by the salt flowage. One major company is currently investigating the possibility of drilling through the salt section using nitrogen as the circulating medium instead of drilling mud.

Central Montana . . . Currently one of the most active areas in the Rockies, Central Montana is a relatively new important drilling area. Discovery of Amsden oil at Wolf Springs and Heath-sand production at Ivanhoe dome has enhanced the oil possibilities of Montana. Drilling depths fall in the 4,000 to 7,000-ft. bracket as a rule.

DRILLING . . . REPORTS

Here's where

by Norman S. Morrisey
Drilling-Development Editor

tools are turning to the right ↓

The Journal's Annual Drilling Survey gives a complete rundown on the most active oil fields in the United States and Canada. The drilling reports include: footage prices, day rates, bit requirements, mud and casing programs, drilling conditions, total days required to drill the field wells, etc.

These are for typical development wells in each of the oil fields listed and they are for average drilling conditions in the field. For detailed information, operators, and contractors undoubtedly will check offset wells and discuss the drilling problems with people familiar with local conditions. But these drilling reports will serve as a very useful guide in figuring costs, setting up a drilling program, or submitting bids.

The severe winters are the most serious obstacle to successful drilling operations, but this statement applies to nearly the entire Rocky Mountains and cannot be considered as unusual to the area.

Wyoming . . . Drilling activities in Wyoming are scatttered over nearly the entire state. Depths vary greatly, depending upon the oil field and the pay zones. Recent exploration activity along the west side of the Powder River basin should be the forerunner of a wildcat program for the east flank of the Big Horn Mountains in both Wyoming and Montana.

The search for gas reserves has stepped up drilling in southwestern Wyoming and northwestern Colorado.

● Rocky Mountains

Williston Basin

ANTELOPE FIELD
McKenzie County, North Dakota

Pay zone	Madison limestone
TD (avg.)	9,150 ft.

Cost Data

Day-work rate	*$925.00

*Plus drill-pipe rental.

Normal Rig-Time Distribution

Total days (spud to rig release)	46

Bit Data

Total number of bits	45

Equipment

Fuel: Butane.
Water supply: Hauled from ponds, etc.
Nearest supply center: Williston, N. D.
Terrain and roads: Terrain, rough; roads, poor.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	600	450
Oil string	7	9,150	1,200

Remarks: Casing must be extra heavy through Spearfish and Charles salt sections to withstand collapse.

Typical Mud Program

Interval, ft.	0-5,500	5,500-9,150
Type mud	Water	Salt saturated
Weight, lb. per gal.		10.6
Filter cake, in.		2/32
Viscosity, sec.		50
Water loss, cc.		5

Remarks: Mud carried with salt saturation of 330,000 p.p.m.

Mud Summary

Material—	Amount
Impermix, sacks	375
Salt, sacks	1,640
Lignox, sacks	180
Barafoss, sacks	100
Micatex, sacks	15
Defoamer, sacks	6
Preservative No. 5, sacks	875
Crude oil, bbl.	315

Geological Data

Formation—	Depth (ft.)
Spearfish	6,200
Charles	8,000
Madison	8,600

CABIN CREEK FIELD
Fallon County, Montana

Pay zone	Siluro-Ordovician
TD (avg.)	9,100 ft.

Normal Rig-Time Distribution

Days on footage rate	35.0
Days on day-work rate	1.0
Total days (spud to rig release)	50.0

Rocky Mountains

Williston basin . . . Antelope, Cabin Creek, Pine, East Poplar.

Central Montana . . . Wolf Springs.

Wyoming . . . Beaver Creek, Donkey Creek.

Denver-Julesburg basin . . . Cizek, Lovercheck, Xenia.

Western Colorado . . . Thornburg.

Paradox basin . . . Aneth.

San Juan basin . . . Bisti-Black Rock, Blanco, Fulcher-Kutz, Tapacito, Ignacio.

●

West Texas-New Mexico (Deep)

Andrews (Wolfcamp), Dean (Devonian), Deep Rock (Ellenburger), Emma (Ellenburger), Hutex (Devonian), North Russell (Devonian), World, West (Strawn).

●

West Texas-New Mexico (Shallow)

Dune (San Andres), High Lonesome, Justiceburg (Glorieta), Lee Harrison, McElroy, McFarland (Queen), Pecos Valley, Revilo (Glorieta), Sunniland.

●

Texas Panhandle

Panhandle, West.

●

North Texas

Archer County Regular, Fargo East, Joy, KMA, Langston-Kleiner, Miles-Jackson, Sherman.

●

Texas Gulf Coast

Danbury dome, Liberty, South, Olivia, Pierce Junction.

●

South Louisiana

Anse La Butte, Grand Isle Block 18.

●

Ark-La-Tex

Greenwood - Waskom, Haynes, East Red Rock.

●

Oklahoma

Cherokee Trend, Eola, Falls, Northeast, Hugtoton (deep), Madill, North, Laverne, Short Junction.

●

KANSAS

Holley, Interstate, Larned.

●

California

Bandini, Santa Fe Springs.

●

Canada

Coleville, Fort. St. John, Harmattan, Pembina, Steelman, Virden-Roselea.

Bit Data

Total number of bits	52
Feet per bit	175

Fuel: Diesel.
Water supply: Water wells in the area.
Nearest supply center: Glendive, Mont.
Terrain and roads: Rough rolling hills and prairie. Roads to Glendive good to fair. Field roads constructed as drilling program progresses.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝ or 10¾	1,050	500
Intermediate	7⅝	7,000	500
Oil string	5½	8,860	700

Remarks: Intermediate casing used in south portion of field.

Typical Mud Program

Interval, ft.	0-5,000	5,000-TD
Type mud	Water base	Saturated salt base
Weight, lb. per gal.	9.5	10.1
Viscosity, sec.	38	45
Water loss, cc.	High	11

Remarks: Water-base mud to top of salt (5,000 ft.); saturated-salt-base mud to TD.

Mud Summary

Material—	Amount
Salt gel, lb.	50,500
Salt, lb.	39,000
Starch, lb.	25,000
Gypsum, lb.	3,000
Quebracho, lb.	500
Caustic, lb.	200
Phosphate, lb.	100
Hulls, lb.	3,500
Peservative, lb.	2,400
Bentonite, lb.	30,000

Geological Data

Formation—	Depth (ft.)
Greenhorn	3,025
Piper	5,200
Amsden	6,100
Kibbey	6,525
Charles	6,650
Mission Canyon	7,100
Lodgepole	7,650
Silurian	8,200
Stony Mountain	8,650
Red River	8,725

PINE FIELD
Prairie County, Montana

Pay zone	Siluro-Ordovician
TD (avg.)	9,050 ft.

Normal Rig-Time Distribution

Days on footage rate	35.0
Days on day-work rate	10-13
Total days (spud to rig release)	48.0

Bit Data

Total number of bits	48
Feet per bit	178

Equipment

Fuel: Diesel.
Water supply: Water wells in the area.
Nearest supply center: Glendive, Mont.
Terrain and roads: Rough rolling hills and prairie. Roads to Glendive good to fair. Field roads constructed as drilling program progresses.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	1,010	350
Oil string	5½	8,900	700

Typical Mud Program

Interval, ft.	0-5,080	5,000-TD
Type mud	Water base	Saturated salt base
Weight, lb. per gal.	9.5	10.2
Viscosity, sec.	32	55
Water loss, cc.	High	10

Remarks: Water-base mud to top of salt (5,000 ft.), saturated-salt-base mud to TD.

Mud Summary

Material—	Amount
Salt, lb.	47,500
Salt gel, lb.	20,000
Starch, lb.	23,000
Gypsum, lb.	2,000
Preservative, lb.	1,400
Defoamer, gal.	7
Oil, bbl.	200

Geological Data

Formation—	Depth (ft.)
Greenhorn	2,900
Piper	5,000
Amsden	6,150
Charles	6,850
Mission Canyon	7,250
Lodgepole	7,800
Silurian	8,400
Stony Mountain	8,750
Red River	8,900

Remarks: Drilling rigs: 10,000-ft. class.

EAST POPLAR FIELD
Roosevelt County, Montana

Pay zone	Madison lime
TD (avg.)	5,900 ft.

Cost Data

Footage price	$5.25
Day-work rate with drill pipe	$850.00
Day-work rate without drill pipe	$775.00

Normal Rig-Time Distribution

Days on footage rate	20
Days on day-work rate	5
Total days (spud to rig release)	25

Bit Data

Total number of bits	15
Feet per bit	393

Equipment

Fuel: Diesel.
Water supply: Poplar River runs through the field.
Nearest supply center: Williston, N. D.—76 miles east.
Terrain and roads: Rolling wheat land. Rigs moved by skidding.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	150	200
Intermediate	9⅝	1,000	400
Oil string	5½	5,900	300

Remarks: 13⅜-in. pipe set in river-bottom areas to seal off surface gravel.

Typical Mud Program

Interval, ft.	0-1,000
Type mud	Native and bentonite
Weight, lb. per gal.	12.5
Viscosity, sec.	45
Interval, ft.	1,000-4,000
Type mud	Native and water
Interval, ft.	4,000-TD
Type mud	Red mud with 10 per cent oil
Weight, lb. per gal.	10.4
Filter cake, in.	2/32
Viscosity, sec.	45
Water loss, cc.	10 or less

Remarks: High mud weight in surface hole is necessary to control shallow gas zone.

Mud Summary

Material—	Amount
Weight material, sacks	700
Gel, sacks	140
Driscose, sacks	16
Caustic, sacks	47
Quebracho, lb.	64
Crude oil, bbl.	100

Geological Data

Formation—	Depth (ft.)
Judith River	750
Dakota	3,200
Piper lime	4,400
Amsden	4,800
Madison	5,500

Central Montana

WOLF SPRINGS FIELD
Montana

Pay zone	6,150 ft.—Amsden dolomite, fractured, vuggy.
TD (avg.)	6,235 ft.

Cost Data

Footage price	*$5.50
Day-work rate with drill pipe	$750.00 plus d.p. rental
Day-work rate without drill pipe	$750.00

*Lost-circulation clause is added to contract.

Normal Rig-Time Distribution

Days on footage rate	14-16
Days on day-work rate	6-10
Total days (spud to rig release)	22-24

Bit Data

Total number of bits	20
Feet per bit	310

Equipment

Fuel: Distillate.
Water supply: 12-mile haul by truck.
Nearest supply center: Roundup, Mont.
Terrain and roads: Rolling terrain; 20 miles of unpaved road.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	309	185
Oil string	5½	6,266	200

Typical Mud Program

Interval, ft.	0-3,000	3,000-TD
Type mud	Natural	Magcogel
Weight, lb. per gal.		9.2-9.7
Filter cake, in.		2/32
Viscosity, sec.		33-67
Water loss, cc.		8

Remarks: Fiber used to combat lost circula-

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- Indian Crevice Seal
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- Indian Hi-Vis-Gel
- Indian Perlite
- Indian Seeco-Mul
- Indian Sodium Bicarbonate
- Indian Barium Carbonate
- Indian Oilfas
- Indian Special Chemical
- Indian Emulso
- Indian Red Mud
- Indian Atomflo
- Indian S.A.P.P.
- Indian T.S.P.P.
- Indian Starch Preservative
- Indian Tannel
- Indian Hydrated Lime
- Indian Salt
- Indian Cedar Seal
- Indian Super Bridge
- Indian Silva Tan
- Indian Santamerse
- Indian Strata Seal
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WAREHOUSES IN ALL ACTIVE AREAS

tion. Mud bills vary from $5,000 to $14,000 depending upon lost circulation.

Mud Summary

Material—	Amount
Magcogel, lb.	12,800
Mud fiber, lb.	1,209
Fiber seal, lb.	2,400
Quebracho, lb.	1,000
Magco fiber, lb.	2,500

Geological Data

Formation—	Depth (ft.)
Judith River	2,268
Eagle	2,870
Muddy	5,030
Dakota silt	5,130
Lakota	5,506
Swift	5,718
Rierdon	5,912
Piper	6,140
Amsden	6,196

Remarks: Fairly soft drilling is encountered until the Muddy is reached after which 100 ft. to 150 ft. per day may be expected.

Wyoming

BEAVER CREEK FIELD
Fremont County, Wyoming

Pay zone	Madison
TD (avg.)	11,500 ft.

Cost Data

Footage price	Day rate
Day-work rate with drill pipe	$950.00 plus 1½ cents per ft.
Day-work rate without drill pipe	$950.00

Normal Rig-Time Distribution

Days on day-work rate	90
Total days (spud to rig release)	90

Bit Data

Total number of bits	135
Feet per bit	85

Equipment

Fuel: Gas from field.
Water supply: Well in field.
Nearest supply center: Casper, Wyo.
Terrain and roads: Rolling terrain, good roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	500	450
Intermediate	9⅝	8,250	2,000
Oil string	7	11,500	600

Remarks: Intermediate string set through Dakota Group, and on top of the Morrison.

Typical Mud Program

Interval, ft.	0-500		
Type mud	Bentonite		
Weight, lb. per gal.	8.5-9.5		
Filter cake, in.			
Viscosity, sec.	35-45		
Water loss, cc.			
Interval, ft.	500-10,000		
Type mud	Bentonite		
Weight, lb. per gal.	10.2-10.5		
Filter cake, in.			
Viscosity, sec.	38-50		
Water loss, cc.	12-15 in 30 min.		
Interval, ft.	10,000-TD		
Type mud	Oil emulsion		
Weight, lb. per gal.	10.2-10.3		
Filter cake, in.			
Viscosity, sec.	60-85		
Water loss, cc.	6-10 in 30 min.		

Remarks: The 10,000 ft. above refers to the top of the Phosphoria.

Mud Summary

Material—	Amount
Barites, sacks	2,200
Gel, sacks	900
Barium carbonate, sacks	200
Caustic soda, sacks	40
Quebracho, sacks	75
Lost-circulation materials, sacks	40

Geological Data

Formation—	Depth (ft.)
Wasatch	0- 1,200
Mesaverde sands and shales	1,200- 3,700
Cody shale	3,700- 6,700
Frontier sands and Mowry shale	6,700- 7,900
Dakota sand and shale group	7,900- 8,250
Morrison shale and Sundance and Nugget sands	8,250- 9,050
Chugwater	9,050-10,100
Phosphoria, Tensleep, and Amsden sands, dolomites, and shales	10,100-11,200
Madison lime	11,200-11,800

Remarks: Above data are for Madison development well only. Other producing horizons and their average depth are the Tensleep at 10,500 ft., the Dakota group at 7,900 ft., the Frontier at 6,700 ft., and the Mesaverde at 3,700 ft. The Madison is the major producing horizon at Beaver Creek.

DONKEY CREEK FIELD
Crook County, Wyoming

Pay zone	Dakota and Muddy
TD (avg.)	6,300 ft.

Normal Rig-Time Distribution

Days on footage rate	12
Days on day-work rate	2
Total days (spud to rig release)	15

Bit Data

Total number of bits	8 to 10
Feet per bit	650 to 700

Equipment

Fuel: Natural gas.
Water supply: Water wells.
Nearest supply center: Newcastle, Wyo.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	150	100
Oil string	5½	6,300-TD	125

Typical Mud Program

Interval, ft.	0-500	5,000-TD
Type mud	Water	Gel
Weight, lb. per gal.		9.5-10.8
Filter cake, in.		2/32
Viscosity, sec.		50-65
Water loss, cc.		8-10

Mud Summary

Material—	Amount
Aquagel, sacks	25
Tannex, lb.	200
Caustic, lb.	50

Geological Data

Formation—	Depth (ft.)
Niobrara	4,500
Green Horn	5,040
Muddy	6,015
Dakota	6,250

DRILLING . . . *REPORTS*

WINKLEMAN (CURTIS SAND)
Fremont County Wyoming

Pay zone	Lower Curtis zone
TD (avg.)	2,750 ft.

Cost Data

Footage price	$8.00
Day-work rate with drill pipe	$700.00
Day-work rate without drill pipe	$625.00

Normal Rig-Time Distribution

Days on footage rate	30 (To Tensleep)
Days on day-work rate	8
Total days (spud to rig release)	39

Bit Data

Total number of bits	19 (To Alcova)
Feet per bit	145

Equipment

Fuel: Butane.
Water supply: Stanolind (Winkleman dome).
Nearest supply center: Riverton.
Terrain and roads: Fairly gentle slopes.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	255.91	225
Oil string	5½	2,835.12	125

Remarks: Centralizers at 2,832.12, 2,770.67, 2,708.55, 2,647.53, and 2,585.78 ft. Baker float collar at 2,803.12 ft.

Typical Mud Program

Interval, ft.	270-2,258	2,475-2,645	2,645-2,767
Type mud	Water (native mud)	Caustic, Mantan	
Weight, lb. per gal.		9.3-9.6	9.6-9.8
Filter cake, in.		2/32	
Viscosity, sec.		42-52	45-46
Water loss, cc.		10	

Mud Summary

Material—	Amount
Caustic, lb.	775
Tannex, sacks	8
Quebracho, lb.	300
Anhydrox, lb.	600
Aquagel, sacks	27
ManTan, lb.	100
Driscose, sacks	3
Crude oil, bbl.	40

Geological Data

Formation—	Depth (ft.)
Frontier sand (4th and 5th)	609 and 757
Mowry shale	885
Thermopolis shale	1,021
Muddy zone	1,183
Dakota sand	1,408
Lakota sand	1,465
Sundance formation	1,862
Nugget sand	2,299
Basal Curtis sand	2,740
Alcova limestone	2,754
Dinwoody shale	3,634
Phosphoria formation	3,716
Tensleep sand	4,018

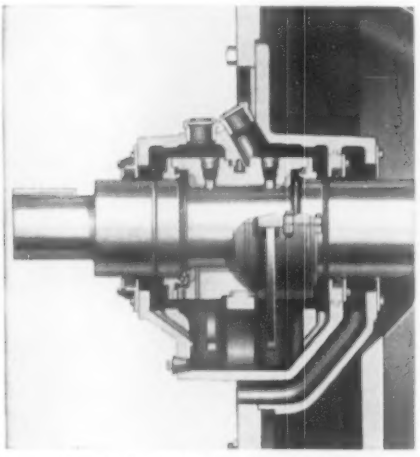
Denver-Julesburg Basin

CIZEK FIELD
Kimball County, Nebraska

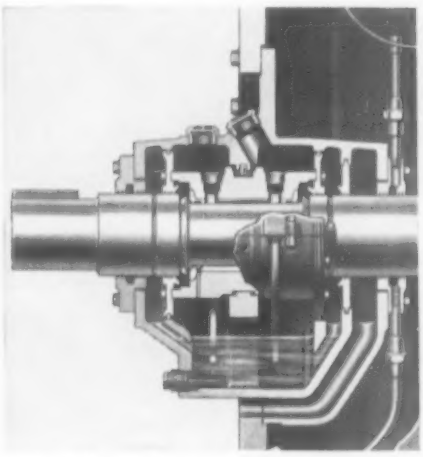
Pay zone	J sand
TD (avg.)	5,700 ft.

NEW Bearing Design Means Better Motor Performance

Allis-Chalmers capsule-type sleeve bearings now perfected for complete motor line



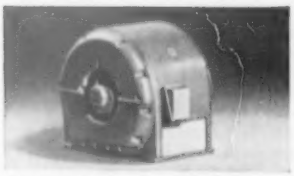
Standard capsule-type sleeve bearing



High speed capsule-type sleeve bearing

A new feature—an improved capsule-type bearing design—has been added to the Allis-Chalmers complete line of large end-shield bearing motors. This new bearing will give you better motor service, simplified maintenance and longer motor life through features like:

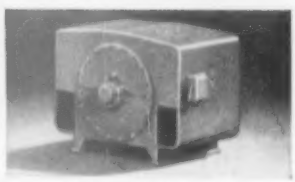
- Dust-tight, leakproof enclosure protects bearing from dirt, dust or abrasive materials.
- Venting system prevents oil leakage — keeps oil and vapor from getting into motor enclosure.
- Dual oil-rings insure bearing surface lubrication — either ring can adequately lubricate bearing.
- Split end-shield gives easy accessibility to winding and air gap — without disturbing capsule or bearing alignment.



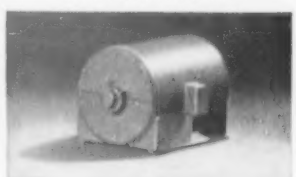
Drip-proof or splash-proof cage motor

Synchronous or wound-rotor motor

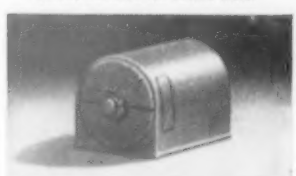
High speed cage motor



Weather-protected motor



Totally-enclosed fan-cooled motor



Totally-enclosed forced-ventilated motor

Water-cooled or inert-gas-filled motor

Capsule-type bearings are standard on these Allis-Chalmers motors.

You get **MORE** from Allis-Chalmers motors

More design and construction features — more application help. For complete information, contact your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5032

Cost Data

Footage price	$2.65
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	9
Days on day-work rate	2
Total days (spud to rig release)	12

Equipment

Fuel: Butane or propane.
Water supply: Haul 15 miles.
Nearest supply center: Kimball, Neb.
Terrain and roads: Wheat land, gravel roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝ or 10¾	675	400 to 500
Oil string	5½	5,700	100

Typical Mud Program

Interval, ft.	0-4,000	4,000-5,700
Type mud	Water	Gel
Weight, lb. per gal.		9.5 to 10
Filter cake, in.		2/32 to 3/32
Viscosity, sec.		45
Water loss, cc.		7

Remarks: Lost circulation in J sand. Average mud bill is $1,000.

Geological Data

Formation—	Depth (ft.)
D sand	5,550
J sand	5,650

LOVERCHECK FIELD
Banner County, Nebraska

Pay zone	D and J sands, Dakota series
TD (avg.)	6,300 ft.

Cost Data

Footage price	$2.60
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	10
Days on day-work rate	4
Total days (spud to rig release)	14

Equipment

Fuel: Diesel.
Water supply: Wells.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	450	300
Oil string	5½ or 4½	6,300	125

Geological Data

Formation—	Depth (ft.)
Both D and J sands of Dakota series	6,200-6,300

XENIA AREA FIELD
Washington County, Colorado

Pay zone	Lower Cretaceous, Dakota series, J sand.
TD (avg.)	4,975 ft.

Cost Data

Footage price	$2.75
Day-work rate with drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	5
Days on day-work rate	2
Total days (spud to rig release)	7

Bit Data

Total number of bits	5
Feet per bit	1,000

Equipment

Fuel: Propane.
Water supply: Wells or ponds.
Nearest supply center: Fort Morgan or Sterling.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	175	125
Oil string	5½	4,975	125

Typical Mud Program

Interval, ft.	3,900-TD
Type mud	Gel and chemical
Weight, lb. per gal.	10.4
Filter cake, in.	2/32
Viscosity, sec.	80
Water loss, cc.	5

Mud Summary

Material—	Amount (lb.)
Anhydrox	
Aquagel	6,600
Farafos	500
Hydrotan	850
Lime	

Geological Data

Formation—	Depth (ft.)
Niobrara	3,900
Timpas (Fort Hays)	4,230
Carlile	4,275
Mowry	4,605
D sand	4,695
J sand	4,775
Skull Creek	4,920

THORNBURG FIELD
Moffat County, Colorado

Pay zone	Weber
TD (avg.)	4,400 ft.

Cost Data

Footage price	$9.50
Day-work rate with drill pipe	*$745.00
Day-work rate without drill pipe	$745.00

*Plus 1½ cents per foot drill pipe rental.

Normal Rig-Time Distribution

Days on footage rate	30
Days on day-work rate	6
Total days (spud to rig release)	36

Bit Data

Total number of bits	32
Feet per bit	140

Equipment

Fuel: Natural gas in field.
Water supply: Hauled by truck 8 miles from creek.
Nearest supply center: Craig, Colo.
Terrain and roads: Mountainous—dirt and gravel roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	175	100
Oil string	7	4,300	150

Typical Mud Program

Interval, ft.	0-3,000	3,000-4,000	4,000-TD
Type mud	Water	Water—gel	Oil emulsion

Remarks: Because of some slight loss circulation, mud up at 3,000 ft. Use some emulsifier before the pay zone and add oil.

Mud Summary

Material—	Amount
Controlgel, tons	15
Caustic soda, tons	¼
Control fiber, lb.	400
Barium carb., tons	¾
Controltan, tons	½
Cottonseed hulls, tons	1
Mica, lb.	1,750
Quebracho, tons	¼
Sealflake, lb.	650

Paradox Basin

ANETH FIELD
San Juan County, Utah

Pay zone	Aneth pay, Desert Creek (basal Hermosa limestone)
TD (avg.)	5,900 ft.

Cost Data

Footage price	$8.50
Day-work rate with drill pipe	*$825.00
Day-work rate without drill pipe	$825.00

*Plus 1½ cents per foot drill-pipe rental.

Normal Rig-Time Distribution

Days on footage rate	41
Days on day-work rate	18
Total days (spud to rig release)	59

Bit Data

Total number of bits	35
Feet per bit	163

Equipment

Fuel: Butane.
Water supply: River or water wells.
Nearest supply center: Farmington, N. M.
Terrain and roads: Rough.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	198	225
Intermediate	9⅝	2,990	300
Oil string	5½	5,995	500

Remarks: This program is now being changed to eliminate the intermediate string which will also reduce drilling days.

Typical Mud Program

Interval, ft.	0-4,700	4,700-5,000
Type mud	Natural	Salt mud
Weight, lb. per gal.		9.2-9.6
Viscosity, sec.		45-48
Water loss, cc.		10-20
Interval, ft.		5,000-TD
Type mud		Salt mud
Weight, lb. per gal.		9.6
Viscosity, sec.		48-75
Water loss, cc.		5

Remarks: Mud to 4,700 ft. is required to control water flows and sand intrusion. No special requirements.

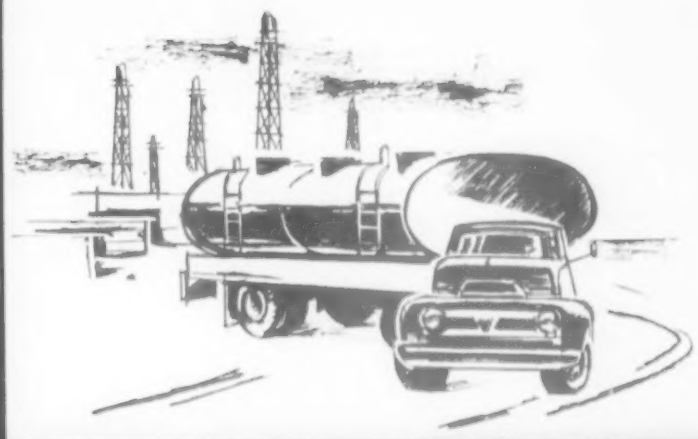
Mud Summary

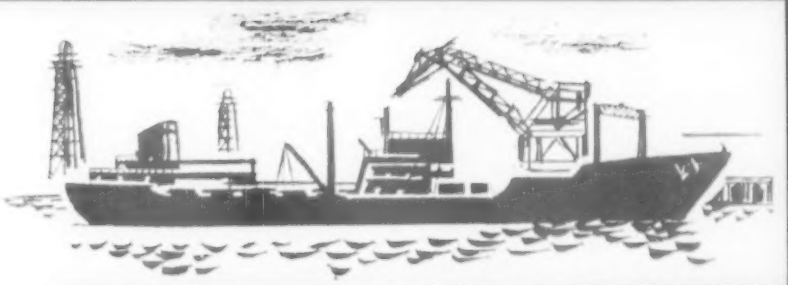
Material—	Amount
Salt, lb.	8,200
Gel, lb.	9,600
Starch, lb.	12,500
Lime, lb.	260
Sodium tetraphosphate, lb.	1,200
Alkali-Tannin, lb.	4,600
Sodium bicarbonate, lb.	500
Barium carbonate, lb.	17,000
Cottonseed hulls, lb.	400

Geological Data

Formation—	Depth (ft.)
Entrada	900

some carry it.....





some ship ...it

but somewhere along the line

..it Flows

through

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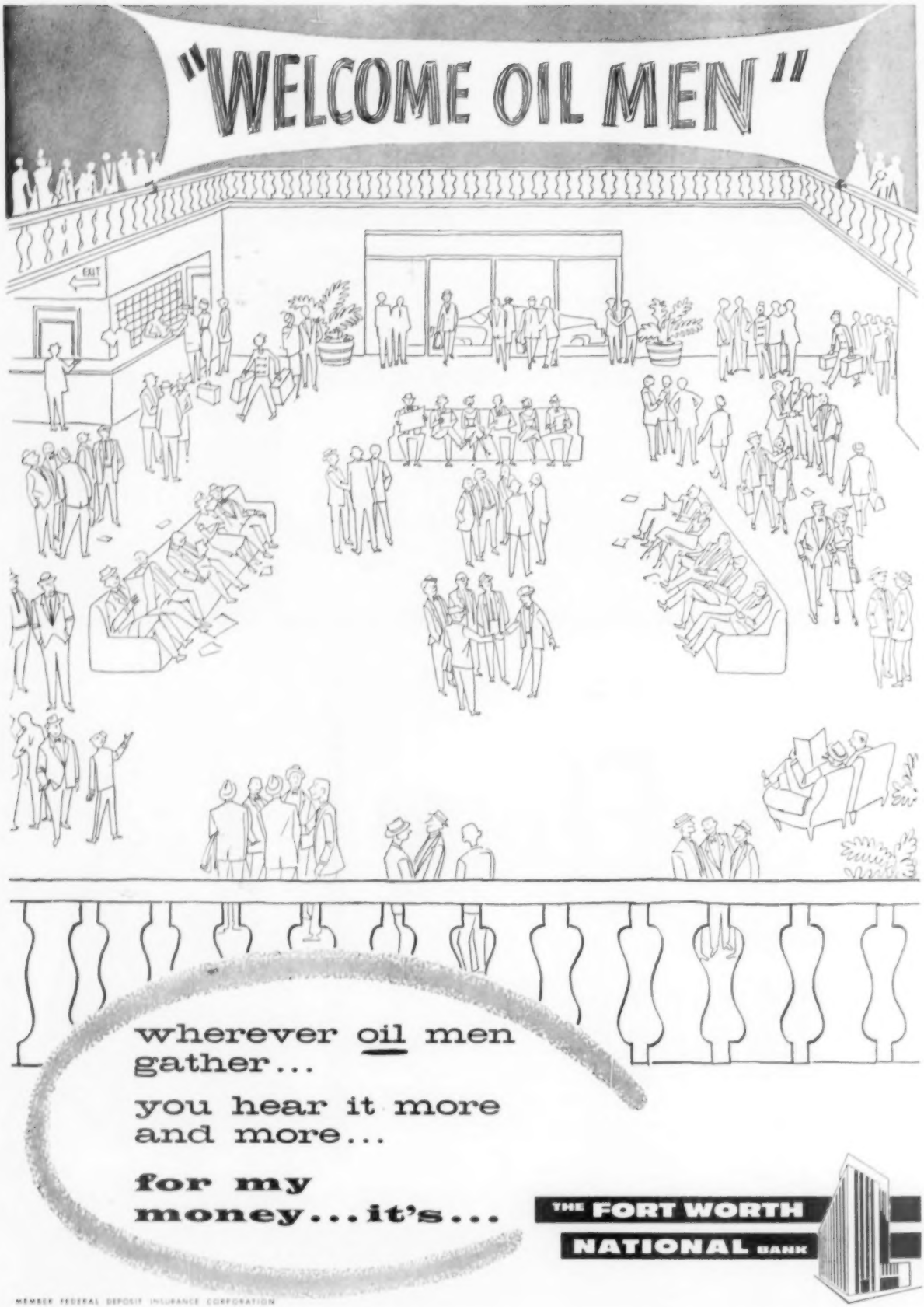
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Chinle	1,600
Shinarump	2,500
Cutler	2,700
Hermosa	4,700
Paradox	5,750
Pinkerton Trail	6,700
Mississippian	7,150
Devonian	7,300

San Juan Basin

BISTI-BLACK ROCK FIELD
San Juan County, New Mexico

Pay zone	Gallup sandstone
TD (avg.)	5,085 ft.

Cost Data

Footage price	$3.50 to $4.50
Day-work rate with drill pipe	$650.00-$700.00
Day-work rate without drill pipe	$550.00-$650.00

Normal Rig-Time Distribution

Days on footage rate	11-14
Days on day-work rate	1
Total days (spud to rig release)	12-15

Bit Data

Total number of bits	12
Feet per bit	422

Equipment

Fuel: L.P.G. and diesel.
Water supply: Haul water 30 miles from San Juan River.
Nearest supply center: Farmington—30 miles.
Terrain and roads: Sand hills and rolling terrain; dirt roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	215	175
Oil string	5½	5,083	100

Typical Mud Program

Interval, ft.	2,500-TD
Type mud	Gel-chemical
Weight, lb. per gal.	9.8
Filter cake, in.	2/32
Viscosity, sec.	40
Water loss, cc.	7.5

Remarks: Drill to 2,500 ft. with natural mud. Increase viscosity to 60 cp. and reduce water loss to approximately 6.0 at 4,500 ft.

Mud Summary

Material—	Amount
Gel, lb.	15,000
Phosphates, lb.	300
Aikatan, lb.	1,400
Bicarbonate soda, lb.	200
Calcium chloride, lb.	300
Driscose, lb.	150
Soda ash, lb.	1,000

Geological Data

Formation—	Depth (ft.)
Pictured Cliffs	215
Chara La Ventana	1,520
Cliff House	2,698
Point Lookout	3,658
Mancos shale	3,825
Gallup	4,764
Gallup sand	4,855

BLANCO FIELD
Rio Arriba County, New Mexico

Pay zone	Mesaverde
TD (avg.)	5,800 ft.

Cost Data

Footage price	$4.50
Day-work rate with drill pipe	$725.00
Day-work rate without drill pipe	$675.00

Normal Rig-Time Distribution

Days on footage rate	13
Days on day-work rate	3
Total days (spud to rig release)	16

Bit Data

Total number of bits	18
Feet per bit	322

Equipment

Fuel: Natural gas.
Water supply: Hauled principally. Expense governed by distance.
Nearest supply center: Farmington, N. M.
Terrain and roads: Varies from good to very poor depending on location.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾ or 9⅝	200	175
Intermediate	7⅝ or 7	3,400	200
Oil string	5½ or 5	5,800	150

Typical Mud Program

Interval, ft.	0-200	200-3,400
Type mud	Native	
Weight, lb. per gal.	9.5	10.0
Viscosity, sec.	35	38.0

Remarks: Use minimum mud for surface hole; drill intermediate hole with water to approximately 200 ft. above top of Fruitland. Use gas as circulating medium from 3,400 ft. to TD.

Mud Summary

Material—	Amount
Caustic, lb.	300
Quebracho, lb.	500
Soda ash, lb.	1,400
Gel, lb.	20,000
Control-tan, lb.	300
Weight material, lb.	43,000
Lime, lb.	300
Hulls, lb.	200

Geological Data

Formation—	Depth (ft.)
Ojo Alamo	1,975-2,080
Kirtland	2,080-2,700
Fruitland	2,700-3,200
Pictured Cliffs	3,200-3,385
Lewis	3,385-5,170
Cliff House	5,170-5,260
Menefee	5,260-5,510
Point Lookout	5,510-5,800

Remarks: Usually the drilling rig is released after running production casing. Average time for cable-tool completion rig is 6.5 days.

FULCHER-KUTZ FIELD
San Juan Basin, New Mexico

Pay zone	Pictured Cliffs
TD (avg.)	1,900-2,500 ft.

Cost Data

Footage price	$3.00 to $3.50
Day-work rate with drill pipe	$500.00-$650.00
Day-work rate without drill pipe	$450.00-$600.00

Normal Rig-Time Distribution

Days on footage rate	4-6
Days on day-work rate	4-6
Total days (spud to rig release)	8-12

Bit Data

Total number of bits	4
Feet per bit	350-500

Equipment

Fuel: Natural gas.
Water supply: San Juan River.
Nearest supply center: Farmington, N. M.
Terrain and roads: Rough, dirt roads; rugged terrain.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	90-100	100
Oil string	5½	1,950	*100

*50-50 Pozmix.

Typical Mud Program

Interval, ft.	0-1,900	1,900-1,950
Type mud	Water	Gel
Weight, lb. per gal.		9.0
Viscosity, sec.		45-50
Water loss, cc.		10-20

Mud Summary

Material—	Amount
Gel, sacks	50-75
Soda ash, sacks	1-2
Man-Tan, lb.	50
Caustic, lb.	10

Geological Data

Formation—	Depth (ft.)
Pictured Cliffs	1,900-2,000

Remarks: Some of these wells are drilled to total depth with clean water and then mudded up for running logs and casing.

TAPACITO FIELD
Rio Arriba County, New Mexico

Pay zone	Pictured Cliff sandstone
TD (avg.)	4,000 ft.

Cost Data

Footage price	$3.00-$3.50
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	7
Days on day-work rate	3
Total days (spud to rig release)	10

Bit Data

Total number of bits	8
Feet per bit	500

Fuel: Butane and natural gas.
Water supply: Water wells.
Nearest supply center: Farmington, N. M. (115 miles).
Terrain and roads: Terrain, rough; roads, poor.

Casing Program

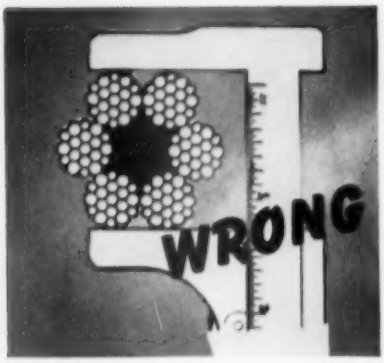
	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	400	235
Oil string	5½	4,000	300

Typical Mud Program

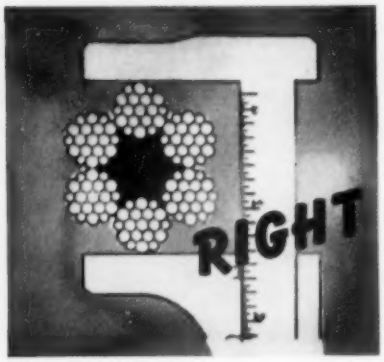
Interval, ft.	0-3,000	3,000-TD
Type mud	Natural	Diesel oil emulsion
Weight, lb. per gal.	9.3-9.5	9.0
Filter cake, in.	⅛	1/64
Viscosity, sec.	40	60
Water loss, cc.	20-50	5-8

Tuffy® Tips

If Present Rope Is Correct Size, Measure with a Caliper



Measuring the Wrong Diameter is a common mistake that some buyers make when they order replacement rope. When the rope arrives, it turns out to be too small—even though a machinist's caliper was used to assure accuracy. It's an easy mistake to make, but it's just as easy to remember the *right* way and be sure you get the right size rope. Otherwise both the safety factor and service life of the rope will be reduced.

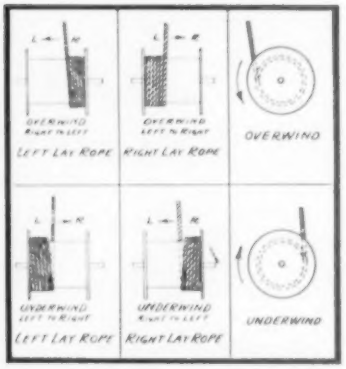


Measuring the Right Diameter is the simple step shown above. Measure so that a single strand is on each of the adjustable edges of the caliper—*not* two strands that measure as a flat side. The actual diameter of a wire rope is the same as that of the circle required to circumscribe it. The diameter of a wire rope is an important factor in determining the safe working load to be handled by your equipment.

How To Measure Groove Diameter

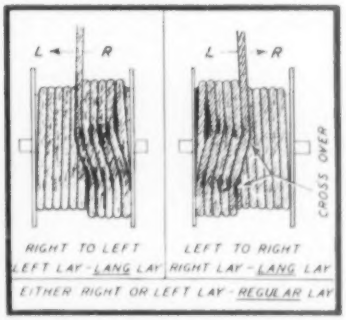
Shown above is the WRONG way to measure the groove diameter. The result—shorter life of the wire rope you buy. Note that only the sides of the rope will bear on the sheave. In a relatively short time this will squeeze the rope out of round and set up destructive friction and stresses on the rope strands and wires. New rope is oversize and diameter of grooves on sheaves and drums should be slightly larger.

Shown above is the *CORRECT* way to measure the groove diameter. It is a simple thing to do and will give the rope you buy a chance to deliver all the service it possibly can. Remember a wire rope is composed of many closely correlated working parts and sheave grooves which are too large or too small throw them out of alignment. Just like any other working part on a machine, wire rope cannot do its best if it is misfitted.



Rope Lay for One Layer Winding

These diagrams show when it is best to use right lay or left lay rope on one-layer winding. The direction of winding is determined by standing behind the drum, looking toward the direction of the rope travel.



Rope for Two Or More Layer Winding

When a rope winds on the first layer across the face of a drum, it usually travels in a uniform pattern. But when it reaches the flange of the drum, the rope rides on the last strand of the first layer for one turn. Then, it slips into the grooves between each course of rope on the first layer. To move across the drum in this manner, the rope actually winds *back* a turn in each revolution. Then it must jump across *two* grooves in the first layer. This always occurs on the even-numbered layers, and often causes crushing. This abuse is minimized by use of properly designed grooves, spacers and lifters.

In Shoes Or In WIRE ROPE Misfitting Is Hard On The Pocketbook

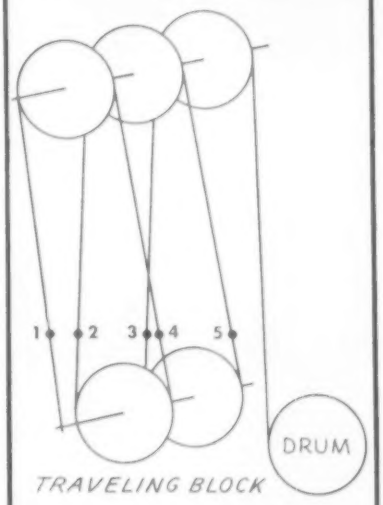
Replace Worn Sheaves

Check for sheaves that have been badly worn. Sheaves that have grooves corrugated by the rope lay impression should be replaced immediately before installing new rope. Since rope creeps to a certain extent on sheaves these grooves can actually cut the strands as the rope runs over. This will greatly reduce service life of *any* wire rope.

Breaking In New Rope

After a wire rope is installed, it is advisable always to run the new wire rope with a light load or with no load for a short period of time. This "breaking in" process gives the component parts of the rope an opportunity to adjust themselves to the conditions under which the rope is to operate. The time spent "breaking in" a wire rope will pay dividends in extra useful rope life.

How To Count The Number of Parts Supporting the Load



Draw an imaginary line across the parts of the rope supporting the load.

The wire rope on many machines is not used in a single or direct pull. It is often reeved through sheaves, which gives a mechanical power advantage.

Send For Free Chart Which Allows Easy Figuring of Actual Stress On Rope For Any Given Piece of Machinery Reeving From One to Eight Parts.

Don't Say "Wire Rope" – say Tuffy

Standard...

For use with standard rigs drilling in any and all formations. Also for deep drilling beyond 6000 ft. with jackknife rigs. Spools easily, pays off by delivering more ton-miles before cutting is necessary.

Or Jackknife

An extra-flexible rope, spools smoothly on small sheave and drums of jackknife rigs drilling to 6000 feet. Top flight performer on rigs of all types throughout the oil country.

Tuffy Rotary Lines

Ton-Mile Indicator and Log Book. Provides you with a slide-chart method of figuring ton-miles quickly and easily, and with it you get a log book in which to record your ton-mile record.

Cut-Off Practice Book. Outlines the quick easy way to tell when to cut-off and how much. Shows how to obtain maximum service from rotary lines and avoid cutting too much, too soon or too little too late. Carries cut-off tables for derricks of all heights with the various draw works operating in all the major oil territories.

Handbook of Wire Rope for Well Drilling and Servicing. More than 40 pages of useful facts on wire rope for rotary, cable tool drilling and well servicing. Includes sizes and constructions of wire rope for all oil field services, its care, lubrication, abuses, correct handling, seizing and socketing.

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union Wire Rope **corp.**

2102 Manchester Avenue Kansas City 26, Missouri

Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand

Mud Summary

Material—	Amount
Bentonite, sacks	100
Diesel oil, bbl.	200
Driscose, sacks	10
Emulsifier, gal.	50

Geological Data

Formation—	Depth (ft.)
Pictured Cliff sandstone	3,900-4,000

Remarks: No particular problems in this area. Wells are usually drilled through the pay zone. The production casing is set through and perforated for completion. Wells are treated with an average of 20,000 gal. of water and 20,000 lb. of sand.

IGNACIO FIELD
La Plata County

Pay zone	Mesaverde
TD (avg.)	5,600 ft.

Cost Data

Footage price	$4.40
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	15
Days on day-work rate	10
Total days (spud to rig release)	25

Bit Data

Total number of bits	20
Feet per bit	100-800

Equipment

Fuel: Gas and diesel.
Water supply: Florida River.
Nearest supply center: Farmington, N. M.
Terrain and roads: Hilly mesas; dirt roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	250	220
Intermediate	7⅝	3,500	300
Oil string	5½	5,600	200

Typical Mud Program

Interval, ft.	0-3,500	3,500-5,600
Type mud	Light gel	Drill with gas
Weight, lb. per gal.	9.4	
Filter cake, in.	3/32	
Viscosity, sec.	36	
Water loss, cc.	15	

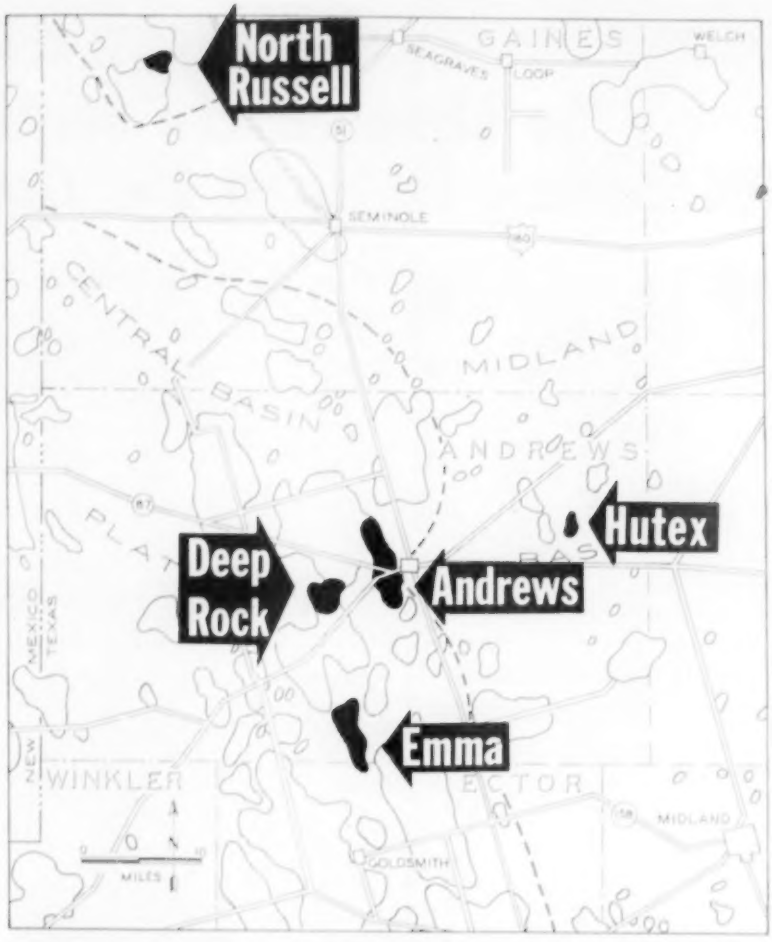
Mud Summary

Material—	Amount
Gel, sacks	300
Quebracho, lb.	800
Soda ash, lb.	600
Caustic, lb.	200

Geological Data

Formation—	Depth (ft.)
Fruitland	2,700
Pictured Cliff	3,100
Mesaverde Transition	4,800
Meaefee	5,200
Point Lookout	5,500
Mancos	5,600

DRILLING . . . *REPORTS*



MUCH OF THE DEEP WEST TEXAS DRILLING is concentrated along the east side of the Central basin platform in Andrews, Gaines, and Ector counties. (Base map courtesy of Midland Map Co.)

West Texas Drills Deeper

TWO significant drilling trends are evident in West Texas. The first is aimed at developing deep Devonian and Ellenburger reservoirs and has been building up for many years in West Texas. This is particularly evident in Lea County, New Mexico, and in Andrews County, Texas. The second trend is of more recent origin and is aimed at developing reserves at shallow and intermediate depths.

This latter trend is largely the result of fracturing and has steadily been gaining in West Texas and New Mexico for the past 2 or 3 years. Permian sands, in particular, respond to fracturing and operators are combing over the old producing trends to uncover pay zones that were originally overlooked.

In the deep-drilling play, the Devonian is taking the spotlight away from the Ellenburger as a reservoir. In Lea County, the Devonian is the primary deep objective since the Ellenburger is missing in many parts of the county.

Probably the most significant factor in drilling during the past few years in West Texas has been the improvement in penetration rates. In 1951, contractors required 120 days, or more, to drill and complete a typical 12,000-ft. Ellenburger field well. Today field wells are drilled to this depth in 70 days or even less. Unfortunately, however, footage prices are tumbling faster than the rate of penetration is improving. The result? The daily gross revenue from a big rig today is actually less than it was 5 years ago.

And this has occurred during a time when labor has increased 28 per cent and the cost of steel and equipment has shot up 23 per cent over the 1951 figures.

It is true in most parts of the coun-

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try, but it is particularly evident in West Texas. The contractor is caught in the tightening vise of higher costs of operating and the steadily decreasing income per foot of hole drilled.

● West Texas-New Mexico (Deep)

ANDREWS (WOLFCAMP) FIELD

Andrews County, Texas

Pay zones: Wolfcamp and Pennsylvanian*
TD (avg.): 9,200 ft. (Penn.); 8,700 ft. (Wolfcamp)

*All wells are dual completions.

Cost Data

Day-work rate with drill pipe	$900.00
Day-work rate without drill pipe	$800.00

Normal Rig-Time Distribution

Days on footage rate	55
Days on day-work rate	17
Total days (spud to rig release)	72

Bit Data

Total number of bits	59
Feet per bit	150

Equipment

Fuel: Butane and natural gas.
Water supply: Hauled from Andrews.
Nearest supply center: Andrews.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	375	375
Intermediate	9⅝	4,600	2,600
Oil string	7	9,200	550

Typical Mud Program

Interval, ft.	0-4,600	4,600-7,800
Type mud	Salt water	Fresh water
Weight, lb. per gal.	11.0	8.3

Interval, ft.	7,800-9,200
Type mud	Caustic quebracho oil emulsion
Weight, lb. per gal.	9.0
Filter cake, in.	2/32
Viscosity, sec.	75
Water loss, cc.	10

Remarks: Average mud bill—$5,000 to $6,000.

Mud Summary

Material—	Amount
Bentonite, sacks	775
Barite, sacks	250
Salt, sacks	375
Lost-circulation material, lb.	5,000
Caustic, lb.	1,000
Quebracho, lb.	650
Oil, bbl.	100

Geological Data

Formation—	Depth (ft.)
Yates	2,090
Permian lime	4,330
Wolfcamp	8,550
Pennsylvanian	8,970

DEAN FIELD

Lea County, New Mexico

Pay zone: Permo-Penn. and Devonian
TD (avg.): 13,800 ft.

Cost Data

Footage price	$9.00 to $9.75
Day-work rate with drill pipe	$1,000.00 to $1,200.00
Day-work rate without drill pipe	$950.00 to $1,150.00

Normal Rig-Time Distribution

Days on footage rate	121
Days on day-work rate	16
Total days (spud to rig release)	143

Bit Data

Total number of bits	121
Feet per bit (average)	113.89

Equipment

Fuel: Diesel.
Water supply: Field wells.
Nearest supply center: Lovington and Hobbs, N. M.
Terrain and roads: Level terrain and good caliche roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	16	358	550 3 per cent
Intermediate	10¾	4,934	2,115 w/1,840 Diamix
Oil string	7	13,780	1,255 w/3 per cent gel

Remarks: Drilled 15-in. hole for 10¾-in. casing. Oil string cemented by two-stage method.

Typical Mud Program

Interval, ft.	0-370	370-4,945	9,450-13,781
Type mud	Fresh water	Salt base	Fresh water
Weight, lb. per gal.	9.5	10-11	9.2-9.5
Filter cake, in.	4/32	2-4 1/32	2/32
Viscosity, sec.	45	40-60	36-100
Water loss, cc.		20-60	5-60

Remarks: Drilled with water from 4,945-9,450 ft.

Mud Summary

Material—	Amount (lb.)
Indian gel	145,400
Lime	100
Salt	60,000
Santomerse	375
High viscosity gel	9,920
Star gel	8,500
Soda ash	8,000
Quebracho	8,100
Caustic soda	6,200
Driscose	1,350
Barite	16,000
S.A.P.P.	3,200
Oilfos	500
Sodium bicarbonate	3,500
Tannel	2,350
Carbothin	900

Geological Data

Formation—	Depth (ft.)
Wolfcamp lime	9,742
Pennsylvanian	10,985
Mississippian	12,804
Devonian	13,756

DEEP ROCK FIELD

Andrews County, Texas

Pay zone: Ellenburger
TD (avg.): 12,260 ft.

DRILLING . . . REPORTS

Cost Data

Footage price	$9.00
Day-work rate with drill pipe	$1,000.00
Day-work rate without drill pipe	$850.00

Normal Rig-Time Distribution

Days on footage rate	89
Days on day-work rate	10
Total days (spud to rig release)	99

Bit Data

Total number of bits	100
Feet per bit	123

Equipment

Fuel: Gas.
Water supply: Shallow fresh-water wells.
Nearest supply center: Andrews.
Terrain and roads: Slightly hilly, good roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	365	450
Intermediate	8⅝	4,510	2,920
Oil string	5½	12,215	1,230

Typical Mud Program

Interval, ft.	1,400-4,500	4,500-8,400
Type mud	Saturated salt water	Fresh water
Weight, lb. per gal.	10.4	
Filter cake, in.		
Viiscosity, sec.	32	

Interval, ft.	8,400-12,200
Type mud	Fresh water gel
Weight, lb. per gal.	9.3
Filter cake, in.	2/32
Viscosity, sec.	60
Water loss, cc.	10

Mud Summary

Material—	Amount
Gel, tons	115
Lost circulation, tons	15
Salt, tons	40
Caustic soda, tons	1
Soda ash, tons	7
Quebracho, tons	3

Geological Data

Formation—	Depth (ft.)
Yates	2,762
San Andres	4,206
Clear Fork	5,972
Pennsylvanian	8,618
Mississippian	9,467
Devonian	10,027
Silurian	11,182
Simpson	11,702
Ellenburger	12,208

EMMA (ELLENBURGER) FIELD

Andrews County, Texas

Pay zone: Ellenburger
TD (avg.): Approximately 12,600 ft.

Cost Data

Footage price	$10.50
Day-work rate with drill pipe	$1,000.00
Day-work rate without drill pipe	$900.00

Normal Rig-Time Distribution

Days on footage rate	90
Days on day-work rate	28
Total days (spud to rig release)	118

Bit Data

Total number of bits	104
Feet per bit	120

THESE JELFLAKE PARTICLES WILL SEAL THE WALL OF THE BORE HOLE, FORMING A BARRIER AGAINST MUD LOSS.

Seals thief zones to prevent mud loss

JELFLAKE* is an efficient, easy-to-use Dowell product designed to keep mud where you want it—in the well. It is used to stop mud loss in drilling wells or to prevent slurry loss during cementing operations.

Particles of Jelflake are made of fragmented plastic foil crinkled to prevent balling. They range in size from pinhead to 2 inches. This variation allows the very small pieces to work their way in and plug the formation while the larger ones form a coating to seal the surface.

Jelflake will stay evenly suspended in mud or cement slurry and can be pumped easily through valves and bit water courses. Non-absorbent, it is unaffected by high pressure, temperature, water, oil or chemical addition agents.

Keep bags of Jelflake on hand for lost circulation control. You can buy it from your local Dowell station, mud distributor or supply store. For your convenience and handling ease, Dowell packages Jelflake in strong, wet-proof, 25-pound bags.

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services for the oil industry

DOWELL

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Equipment

Fuel: Available lease gas, supplemented by contractor's purchase of butane.
Water supply: Water wells drilled by contractor.
Nearest supply center: Odessa, Tex.
Terrain and roads: Flat and sandy.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	300	325
Intermediate	9⅝	4,400	2,350
Oil string	7	12,600	625

Typical Mud Program

Interval, ft.	0-300
Type mud	Water with aquagel
Interval, ft.	300-4,400
Type mud	Saturated salt-water solution
Water loss, cc.	2
Interval, ft.	4,400-12,600
Type mud	Soda ash, gel, caustic and oil emulsion
Weight, lb. per gal.	9-9.2
Filter cake, in.	2/32
Viscosity, sec.	38-8,000 ft. 70-100 below
Water loss, cc.	8-10

Mud Summary

Material—	Amount
Aquagel, sacks	1,600
Zeogel, sacks	27
Salt, sacks	1,560
Caustic soda, lb.	2,900
Soda ash, sacks	25
Tannex, sacks	62
Lime, sacks	4
Fibretex, sacks	123
Gel flakes, sacks	25

Formation—	Depth (ft.)
Glorieta	5,330 (—2,175)
Wolfcamp	8,267 (—5,112)
Woodford	10,280 (—7,125)
Devonian	10,560 (—7,405)
Fusselman	11,573 (—8,418)
Simpson	11,984 (—8,793)
Ellenburger	12,554 (—9,399)

HUTEX FIELD
Andrews County, Texas

Pay zone	Devonian
TD (avg.)	12,575 ft.

Normal Rig-Time Distribution

Days on footage rate	60.5
Days on day-work rate	7.5
Total days (spud to rig release)	68.0

Bit Data

Total number of bits	74
Feet per bit	170

Equipment

Fuel: Lease gas supplemented by gas from Empire Southern Gas Co.
Water supply: Lease water wells.
Nearest supply center: Andrews.
Terrain and roads: Sandy, level terrain. Caliche required on roads and locations.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	11¾	325	350
Intermediate	8⅝	5,000	2,500
Oil string	5½	12,575	1,800

Typical Mud Program

Interval, ft.	0-10,000	10,000-11,000
Type mud	Water	Crude oil emulsion
Weight, lb. per gal.		8.7
Filter cake, in.		2/32
Viscosity, sec.		40
Water loss, cc.		10
Interval, ft.		11,000-12,575
Type mud		Crude-oil emulsion
Weight, lb. per gal.		8.9
Filter cake, in.		2/32
Viscosity, sec.		60-65
Water loss, cc.		8

Remarks: Lost-circulation materials required occasionally but not in all wells.

Mud Summary

Material—	Amount
Quebracho, lb.	1,400
Caustic soda, lb.	2,000
Soda ash, lb.	4,000
Gel, lb.	8,500
Starch, lb.	2,500
Lease crude, bbl.	240

Geological Data

Formation—	Depth (ft.)
Rustler	2,120
Yates	3,230
Grayburg	4,640
Spraberry	8,510
Wolfcamp	9,825
Strawn	10,990
Bend	11,220
Mississippian	11,995
Devonian	12,460

RUSSELL NORTH (DEVONIAN)
Gaines County, Texas

Pay zone	Devonian
TD (avg.)	11,200 ft.

Cost Data

Footage price	$8.00
Day-work rate with drill pipe	$925.00
Day-work rate without drill pipe	$850.00

Normal Rig-Time Distribution

Days on footage rate	55
Days on day-work rate	5
Total days (spud to rig release)	60

Bit Data

Total number of bits	58
Feet per bit	192

Equipment

Fuel: Diesel.
Water supply: Wells, 500 ft. deep.
Nearest supply center: Hobbs, N. M., approximately 25 miles.
Terrain and roads: Rolling; black top and dirt.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	11¾	335	355 (common)
Intermediate	8⅝	4,600	2,100 (1x1 Posmix*)
Oil string	5½	11,070	625 (1x1 Posmix†)

*6 per cent gel. †6 per cent gel plus 200 sacks neat on bottom.

Typical Mud Program

Interval, ft.	300-4,600	4,600-9,000	9,000-11,200
Type mud	Native Red Bed		12 per cent oil emulsion
Weight, lb. per gal.	10.2	8.6-8.8	8.6-8.8
Filter cake, in.			2/32
Viscosity, sec.	30-40	20-40	40-60
Water loss, cc.	20-30	20-30	6-8

Remarks: Usual mud program: Oil emulsion below 9,000 ft. must hold weight to 8.5-9.0 lb. per gal. as lost circulation is greatest problem.

Mud Summary

Material—	Amount
Bentonite, tons	40
Soda ash, lb.	2,000
Caustic, lb.	2,000
Lime, lb.	500
Lignite, lb.	8,100

Geological Data

Formation—	Depth (ft.)
Yates	2,908
Sand Andres	4,660
Glorieta	5,954
Clear Fork	6,075
Wolfcamp	8,638
Mississippian	10,275
Woodford	10,793
Devonian	10,905

Remarks: Axis of Devonian structure lies NW-SE, but axis of Clear Fork structure lies NE-SW.

WORLD, WEST FIELD
Crockett County, Texas

Pay zone	Strawn
TD (avg.)	8,200 ft.

Cost Data

Footage price	$5.00
Day-work rate with drill pipe	$750.00
Day-work rate without drill pipe	$650.00

Normal Rig-Time Distribution

Days on footage rate	31
Days on day-work rate	7
Total days (spud to rig release)	38

Bit Data

Total number of bits	34
Feet per bit	240

Equipment

Fuel: Gas.
Water supply: Fresh water wells (shallow).
Nearest supply center: McCamey.
Terrain and roads: Hilly to mountainous; good roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	780	700
Intermediate	8⅝	3,200	2,050
Oil string	5½	8,200	250

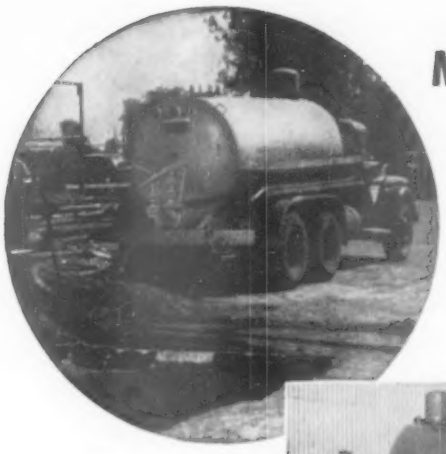
Typical Mud Program

Interval, ft.	0-7,800	7,800-8,200
Type mud	Fresh water	Fresh water gel
Weight, lb. per gal.		8.9
Filter cake, in.		2/32
Viscosity, sec.		45
Water loss, cc.		10

Mud Summary

Material—	Amount
Gel, tons	28
Weight materials, tons	3
Quebracho, tons	½
Soda ash, sacks	¾
Caustic soda, sacks	½
Starch, sacks	2½
Salt, sacks	18

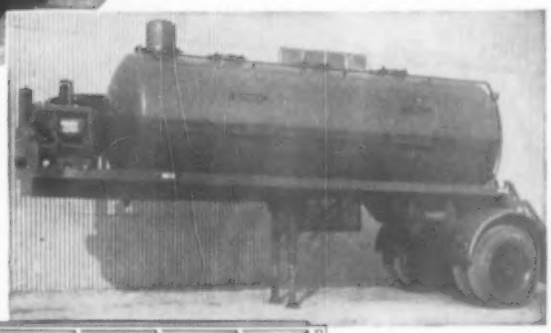
MOVING DRILLING MUD *FAST!*



Just for the record, this moving job during a changeover was timed, and here are the results: Exactly 8 minutes, 33 seconds after the driver yanked up on the emergency brake, 45 bbls. of 12 lb. mud was snugly inside the Thompson Unitized Vacuum Tank!

TO THE NEXT HOLE

From there to the next hole was discounted as driving time. Starting the stop watch again when the driver had backed up to the shaker pit, the one man laid hose, opened the valve and had the tank empty in 4 minutes 10 seconds.



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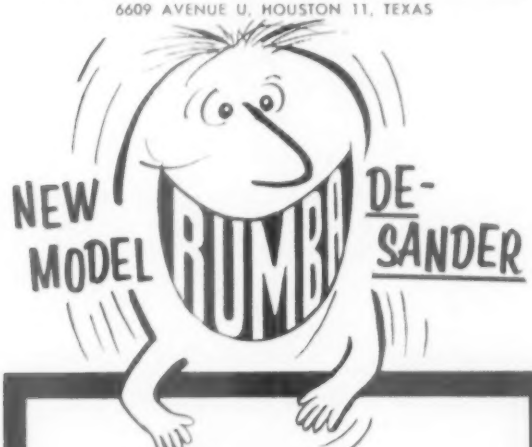

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Geological Data

Formation—	Depth (ft.)
Yates	1,755
San Andres	2,865
Spraberry	5,222
Base Spraberry	6,008
Strawn	8,090
Strawn-Porosity	8,157

Cost Data

Footage price	$3.50
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	13
Days on day-work rate	1
Total days (spud to rig release)	14

Bit Data

Total number of bits	10
Feet per bit	370

Equipment

Fuel: Lease gas.
Water supply: Shallow wells on lease.
Nearest supply center: Odessa.
Terrain and roads: Sandy terrain served with all-weather roads.

● West Texas-New Mexico (Shallow)

DUNE (SAN ANDRES) FIELD
Crane County, Texas

Pay zone	San Andres dolomite
TD (avg.)	3,700 ft.

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DRILLING . . . REPORTS

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	500	300 (1 per cent cc.)
Oil string	5½	3,700	350

Typical Mud Program

Interval, ft.	0-TD
Type mud	Salt gel
Weight, lb. per gal.	10.5
Filter cake, in.	⅛
Viscosity, sec.	40
Water loss, cc.	5 cc.-30 minutes

Remarks: Add oil to reduce water loss before drilling pay.

Geological Data

Formation—	Depth (ft.)
Grayburg lime	3,000
San Andres	3,300

Remarks: Logs run: Gamma ray—neutron, microlaterolog, Laterolog. Completion through perforations, pay ranges from 30-100 ft. in 250 ft. gross section. Fracture all zones together with 20,000 bbl. oil and 30,000 lb. sand at rates of 20-30 bbl. per minute. Completion done with pulling machine.

HIGH LONESOME FIELD
Eddy County, New Mexico

Pay zone	Queens sand
TD (avg.)	1,875 ft.

Cost Data

Footage price (cable tools)	$3.25
Day-work rate (cable tools)	$240.00

Normal Rig-Time Distribution

Days on footage rate	23
Days on day-work rate	8
Total days (spud to rig release)	31

Equipment

Fuel: Butane.
Water supply: By contractor.
Nearest supply center: Artesia, N. M., 30 miles to west.
Terrain and roads: Terrain rolling; field is 8 miles from highway on dirt road.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	250 to 450	100 to 150
Oil string	5½	1,875 (avg.)	250

Geological Data

Formation—	Depth (ft.)
Top salt	400
Base salt	654
Top Yates sand	810
Top Seven Rivers	1,200
Top Queens sand	1,600

JUSTICEBURG (GLORIETA) FIELD
Garza County, Texas

Pay zone	Glorieta
TD (avg.)	2,600 ft.

Cost Data

Footage price	$3.00
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

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600 cfm @ 20 to 100 psi	
1200 cfm @ 20 to 100 psi	
900 cfm @ 500 psi	
1800 cfm @ 100 psi	
1800 cfm @ 500 psi	
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Model 600 Compressor

Model 1D Booster

Model PPC Booster

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Schramm Portable Compressors and Boosters are easy to install. Simply wheel them into position, connect to manifold and begin drilling without further adjustment. All Schramm Boosters and Model 600 Compressors are powered by the same engine, either the International Harvester UD-1091 diesel or U-1091 gas engine. Result: fewer service parts, lowest maintenance.

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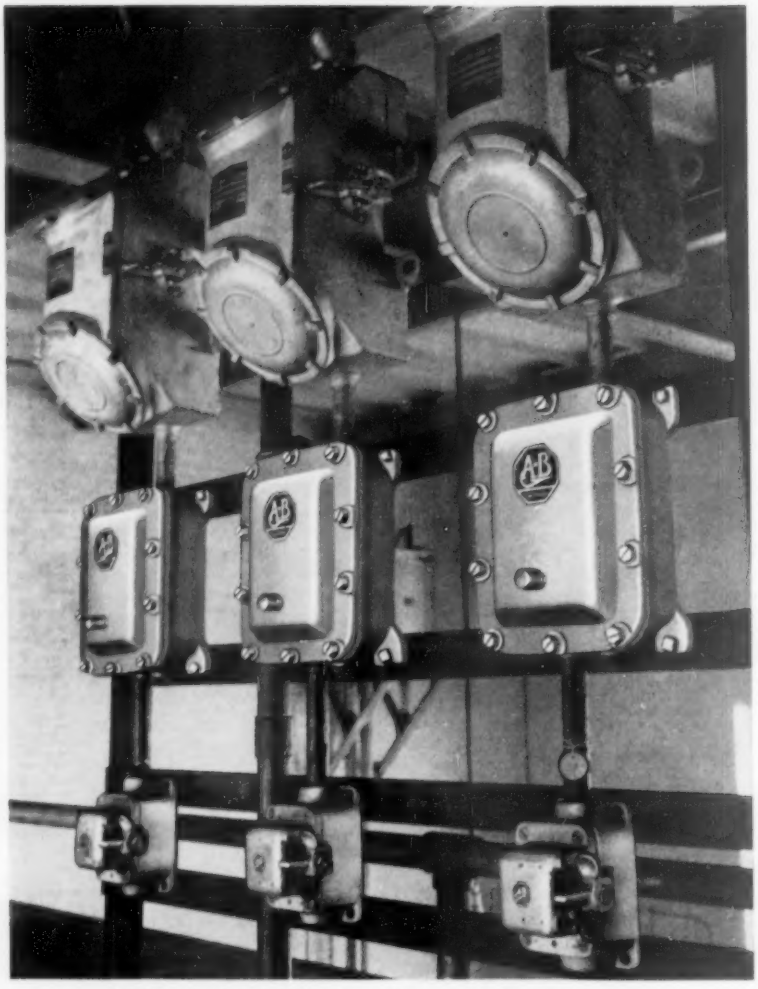

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Normal Rig-Time Distribution

Days on footage rate	7
Total days (spud to rig release)	8-9

Bit Data

Total number of bits	6
Feet per bit	400

Equipment

Fuel: Butane.
Water supply: Salt water, rotary; fresh water, cable.
Nearest supply center: Snyder, Tex.
Terrain and roads: Dry, rocky, and rolling.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	150	50
Oil string	5½	2,600	100

Remarks: Cable tools, 13⅜—150, 8⅝—1,600, 5½—2,600.

Typical Mud Program

Interval, ft.	0-TD
Type mud	Salt water

Mud Summary

Material—	Amount
Zeogel, sacks	100

Geological Data

Formation—	Depth (ft.)
Surface sand and clays	0-150
Red Beds	150-1,600
Lime	1,600-TD

Remarks: Glorieta formation is a sandy dolomite found in lower San Andres lime.

LEE HARRISON (5,500-FT.) FIELD
Lubbock County, Texas

Pay zone	Clear Fork
TD (avg.)	5,000 ft.

Cost Data

Footage price	$4.50
Day-work rate with drill pipe	$700.00 plus 1½ cent per ft. D.P. rental
Day-work rate without drill pipe	$700.00

Normal Rig-Time Distribution

Days on footage rate	17
Days on day-work rate	5
Total days (spud to rig release)	22

Bit Data

Total number of bits	22
Feet per bit	225

Equipment

Fuel: Butane.
Water supply: Lubbock, drilled wells at location.
Nearest supply center: Sundown, Tex.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾ or 8⅝	500	300
Oil string	7 or 5½	4,900	250

Typical Mud Program

Remarks: Use clear water to casing point. No danger of blowout. Total mud costs are $2,000 per well.

Mud Summary

Material—	Amount
Spud mud, sacks	50
Salt gel	as necessary

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DRILLING . . . *REPORTS*

Salt	as necessary
Starch	as necessary

Geological Data

Formation—	Depth (ft.)
Surface sands	0-400
Red Beds	400
Anhydrite	1,550
Yates	2,000
San Andres	3,100
Glorieta	4,400
Clear Fork	4,850

McELROY FIELD
Crane and Upton Counties, Texas

Pay zone	Grayburg and San Andres, 3,010 to 3,490 ft.
TD (avg.)	3,250 to 3,400 ft.

Cost Data

Footage price	$3.50
Day-work rate with drill pipe	$648.00
Day-work rate without drill pipe	$592.00

Normal Rig-Time Distribution

Days on footage rate	18
Days on day-work rate	15
Total days (spud to rig release)	33

Bit Data

Total number of bits	9-10
Feet per bit	300-500

Equipment

Fuel: Natural gas or butane.
Water supply: Water wells on lease.
Nearest supply center: Odessa, Tex.
Terrain and roads: Rolling hills and sand dunes; hard surface access, oil and graded lease roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝ and 8⅝	510	500 and 350
Oil string	7 and 5½	2,950	150 and 100

Remarks: If cable-tool hole, set 13⅜ at 500 ft. with 250 sacks; 10¾ and 8⅝ cave strings are landed at 800 and 1,250 ft. and later pulled. Set 5½-in. casing as above.

Typical Mud Program

Interval, ft.	0-510	510-3,000
Type mud	Gel and native clay	Salt gel
Weight, lb. per gal.	11	10.2
Filter cake, in.	4/32	3/32
Viscosity, sec.	100	34-36
Water loss, cc.	60	15

Remarks: Usual to drill with rotary using mud to oil string casing seat; then set casing and drill in with cable tools.

Mud Summary

Material—	Amount
Marco clay or Bentonite, sacks	30
Salt gel, sacks	40 to 50

Geological Data

Formation—	Depth (ft.)
Yates	2,100
Grayburg	2,900
San Andres	3,200

Remarks: Complete by stimulating pay with approximately 400 qt. nitroglycerin followed by a cleanout, test, and sand oil

treatment using 15,000 gal. lease crude or refined oil and 30,000 lb. 20-40-mesh sand.

McFARLAND (QUEEN) FIELD
Andrews County, Texas

Pay zone	Queen sand (Permian)
TD (avg.)	4,700 ft.

Cost Data

Footage price	$3.25
Day-work rate with drill pipe	$600.00
Day-work rate without drill pipe	$550.00

Normal Rig-Time Distribution

Days on footage rate	12
Days on day-work rate	3
Total days (spud to rig release)	15

Bit Data

Total number of bits	9
Feet per bit	538

Equipment

Fuel: Butane and natural gas.
Water supply: Shallow water sand. Drill water wells.
Nearest supply center: Andrews, Tex. — 8 miles southwest.
Terrain and roads: Paved farm road to field. Caliche lease roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	360	350
Oil string	5½	Through pay	500

Remarks: Various sizes casing used. These sizes are most common.

Typical Mud Program

Interval, ft.	0-375	375-4,600	4,600-TD
Type mud	Natural mud	Natural mud	Salt-base mud
Weight, lb. per gal.			10
Filter cake, in.			2/32
Viscosity, sec.			40
Water loss, cc.			15

Mud Summary

Material—	Amount
Salt gel, lb.	6,000
Starch, lb.	3,000

Geological Data

Formation—	Depth (ft.)
Anhydrite	2,120
Yates	3,320
Queens sand	4,650

Remarks: Drilling in this field is good. There are no mud problems and not much trouble keeping a straight hole. There are no lost-circulation or blowout problems.

PECOS VALLEY FIELD
Pecos County, Texas

Pay zone	Yates sand, Permian age
TD (avg.)	1,630 ft.

Cost Data

Footage price	$4.00
Day-work rate (cable tools)	$216.00

Normal Rig-Time Distribution

Days on footage rate	20
Days on day-work rate	10
Total days (spud to rig release)	30

Equipment

Fuel: Butane and propane.
Water supply: Trucked from Grandfalls, Tex.
Nearest supply center: Monahans, Tex.
Terrain and roads: Flat, alkali top soil underlain by caliche; covered with mesquite underbrush.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	325	250
Intermediate	(*)		
Oil string	5½	1,500	25

*Approximately 760 of 7⅝-in. o.d. and 1,135 ft. of 7-in. o.d. casing are run for temporary water strings. These casing strings are pulled after the well is completed to TD.

Typical Mud Program

Remarks: No mud used. Holes drilled dry, using cable tools.

Geological Data

Formation—	Depth (ft.)
Rustler formation	600
Yates formation	1,500

REVILO (GLORIETA) FIELD
Scurry County, Texas

Pay zone	Permian-Glorieta
TD (avg.)	2,800 ft.

Cost Data

Footage price	$2.75
Day-work rate with drill pipe	$475.00
Day-work rate without drill pipe	$450.00

Normal Rig-Time Distribution

Days on footage rate	7
Days on day-work rate	1
Total days (spud to rig release)	8

Bit Data

Total number of bits	8
Feet per bit	350

Equipment

Fuel: Butane.
Water supply: Snyder, Tex.
Nearest supply center: Snyder, Tex.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	150	150
Oil string	5½	2,800	200

Remarks: Some operators are setting casing through and perforating; others are setting on top of producing interval and drilling plug.

Typical Mud Program

Interval, ft.	0-2,500
Type mud	Salt water
Weight, lb. per gal.	10 or less
Filter cake, in.	2/32
Viscosity, sec.	36/40
Water loss, cc.	20 or less

Remarks: Most operators are drilling to a depth of 2,500 ft. with clear water and using enough starch and salt gel to obtain mud properties as stated above. Mud cost is approximately $400.00 to $500.00 per well.

Geological Data

Formation	Depth (ft.)
San Andres	1,800-1,900
Glorieta	2,550-2,650

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DRILLING . . . *REPORTS*

SUNNILAND FIELD
Lynn County, Texas

Pay zone	Upper San Andres (3,800-3,970 ft.); lower San Andres (4,000-4,150 ft.).
TD (avg.)	4,500 ft.

Cost Data

Footage price	$3.25
Day-work rate with drill pipe	$450.00
Day-work rate without drill pipe	$400.00

Normal Rig-Time Distribution

Days on footage rate	17
Days on day-work rate	4
Total days (spud to rig release)	25

Equipment

Fuel: Butane.
Water supply: Irrigation wells.
Nearest supply center: Post.
Terrain and roads: Farm-to-market, level.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	12⅝	200	150
Oil string	5½ or 7	4,500	200

• Texas Panhandle

PANHANDLE WEST FIELD
Carson and Gray Counties, Texas

Pay zone	Dolomite and granite wash
TD (avg.)	3,400 ft.

Cost Data

Footage price	$3.00
Day-work rate with drill pipe	$520.00
Day-work rate without drill pipe	$480.00

Normal Rig-Time Distribution

Days on footage rate	10
Days on day-work rate	½
Total days (spud to rig release)	10½

Bit Data

Total number of bits	8
Feet per bit	400

Equipment

Fuel: Natural gas or butane.
Water supply: Wells.
Nearest supply center: Pampa or Borger.
Terrain and roads: Terrain varies smooth to rough; roads good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	500	250
Oil string	5½	3,200	150

Typical Mud Program

Interval, ft.	100 above Brown dolomite-TD
Type mud	Starch
Weight, lb. per gal.	10
Filter cake, in.	½
Viscosity, sec.	36-42
Water loss, cc.	10

Remarks: Most companies use starch mud to keep water loss down; however, some use oil-base mud and allow water loss to become higher. 5-10 per cent loss-circulation materials added in Brown dolomite.

Mud Summary

Material—	Amount (sacks)
Bentonite-gel	75
Salt water-gel	90

Starch	90
Fiber	35
Cottonseed hulls	40

Geological Data

Formation—	Depth (ft.)
Tertiary (water sands and gravel)	0- 300
Whitehorse group	300- 550
Blaine	550- 750
Lower Nippewalla and Ninnescah including Cimarron and Stone Coral	750-2,400
Wellington or Wichita Albany	2,400-2,900
Wolfcamp or Brown dolomite	2,900-3,150
Arkosic or granite wash	3,150-3,200

Remarks: Geological data based on well in Gray County, west of Pampa.

• North Texas

ARCHER COUNTY REGULAR FIELD
Archer County, Texas

Pay zone	Votsberger sand
TD (avg.)	4,800 ft.

Cost Data

Footage price	$3.00
Day-work rate with drill pipe	$550.00
Day-work rate without drill pipe	$500.00

Normal Rig-Time Distribution

Days on footage rate	11
Days on day-work rate	1
Total days (spud to rig release)	12-14

Bit Data

Total number of bits	12

Equipment

Fuel: Butane.
Water supply: Field tanks or Lake Wichita.
Nearest supply center: Wichita Falls.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	125	100
Oil string	5½	4,830	200

Typical Mud Program

Remarks: No serious mud problems. Use natural mud to 4,400 ft. then use a caustic and quebracho mud. Viscosity is kept above 36 cp. and weight at 10 lb. per gal.

Geological Data

Formation—	Depth (ft.)
KMA lime	4,175
Hull-Silk	4,375
Votsberger lime	4,667
Votsberger sand	4,775

FARGO EAST FIELD
Wilbarger County, Texas

Pay zone	Basal Strawn conglomerate

Cost Data

Footage price	$3.75
Day-work rate with drill pipe	$800.00
Day-work rate without drill pipe	$750.00

Normal Rig-Time Distribution

Days on footage rate	15
Days on day-work rate	2
Total days (spud to rig release)	17

Bit Data

Total number of bits	18
Feet per bit	335

Equipment

Fuel: Butane.
Water supply: Shallow wells.
Nearest supply center: Vernon and Wichita Falls.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	90	135
Oil string	5½	6,000	200

Typical Mud Program

Interval, ft.	0-5,500	5,500-6,000
Type mud	Natural	Oil emulsion
Weight, lb. per gal.		11
Filter cake, in.		50-55
Viscosity, sec.		10 cc.

Remarks: Mud bill runs about $1,000 per well.

Geological Data

Formation—	Depth (ft.)
Canyon	4,500
Mississippian	6,000

JOY FIELD
Clay County, Texas

Pay zone	Strawn sand
TD (avg.)	4,600 ft.

Cost Data

Footage price	$3.50-$4.50
Day-work rate with drill pipe	$650.00-$750.00

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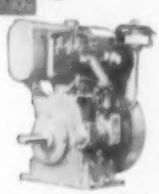
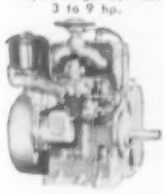
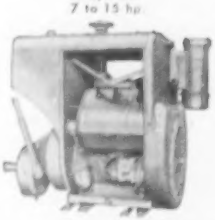

4-cycle Single Cylinder 3 to 9 hp.


2-cylinder 7 to 15 hp.


V type 4-cylinder 15 to 36 hp.

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World's Largest Builders of Heavy-Duty Air-Cooled Engines

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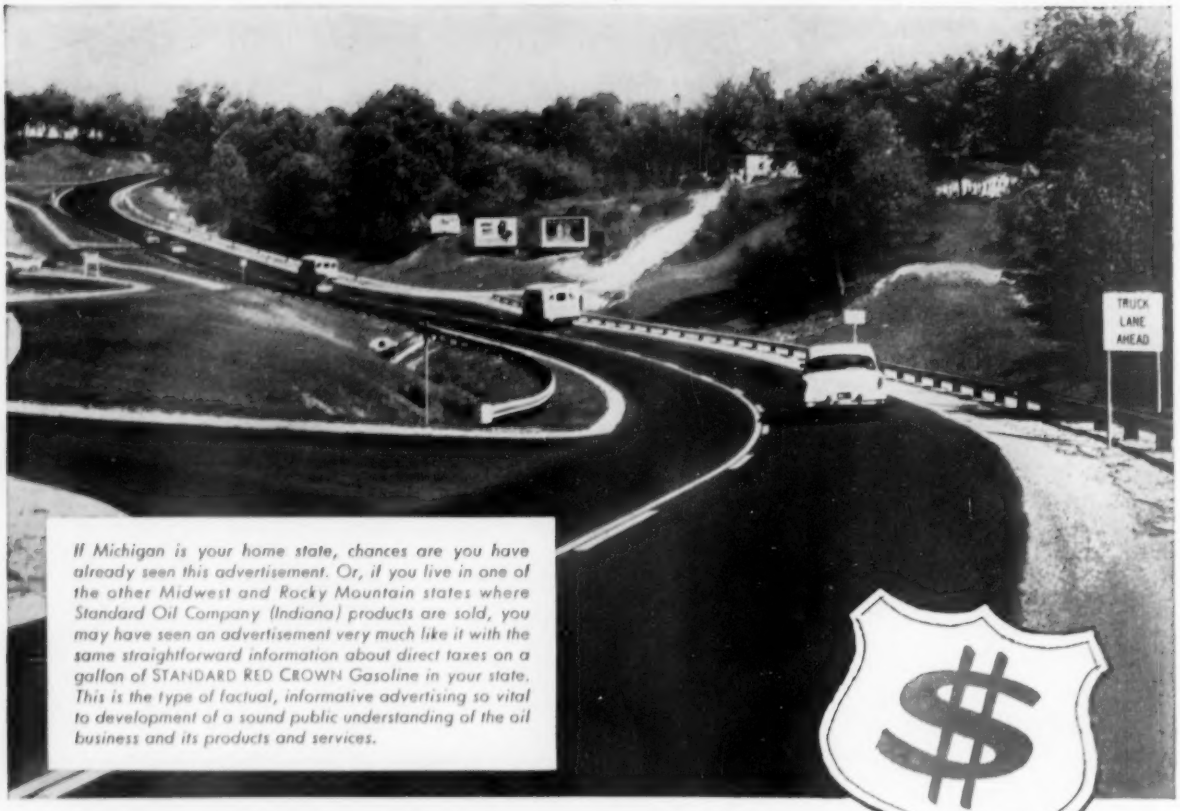


If Michigan is your home state, chances are you have already seen this advertisement. Or, if you live in one of the other Midwest and Rocky Mountain states where Standard Oil Company (Indiana) products are sold, you may have seen an advertisement very much like it with the same straightforward information about direct taxes on a gallon of STANDARD RED CROWN *Gasoline in your state. This is the type of factual, informative advertising so vital to development of a sound public understanding of the oil business and its products and services.*

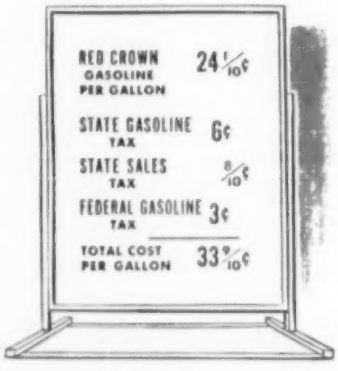
GOOD ROADS ARE NECESSARY EVEN THOUGH THEY COST A LOT!

EVERYBODY wants good roads. You do. We do. They are needed for business, for pleasure, for defense. And everybody realizes that highways cost a whopping amount of money. But not everybody understands just where the money for good, safe highways comes from...

The largest single source is direct gasoline taxes

For example: A typical price of STANDARD RED CROWN Gasoline in mid-Michigan is 24 1/10-cents excluding direct taxes. For this 24 1/10-cents we find crude oil, transport it, refine it, and then deliver the gasoline to your independent Standard Dealer. And your dealer's mark-up, covering his costs and what he earns for serving you, is also included in the same 24 1/10-cents.

State and federal direct taxes total another 9 8/10 cents—which is equal to more than 40 per cent of the price of the gasoline alone. Most of these taxes go for roads.



That's quite a tax bill. But we all know that reasonable taxes are necessary. We are just trying to remind our customers and friends of a simple economic fact. Subtract the taxes from the price *you* pay for RED CROWN Gasoline and you will see that an amount equal to *more than 40 per cent* of the price of the gasoline itself goes for direct taxes.

STANDARD OIL COMPANY (INDIANA) STANDARD

Normal Rig-Time Distribution

Days on footage rate	9
Days on day-work rate	2
Total days (spud to rig release)	11

Bit Data

Total number of bits	9
Feet per bit	520

Equipment

Fuel: Butane.
Water supply: Stock tanks.
Nearest supply center: Wichita Falls, Tex.
Terrain and roads: Hard surface.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	450	150
Oil string	5½	4,600	200

Typical Mud Program

Interval, ft.	3,900-TD
Type mud	Oil emulsion
Weight, lb. per gal.	9.8
Filter cake, in.	2-32
Viscosity, sec.	60
Water loss, cc.	5

Mud Summary

Material—	Amount
Magcogel, sacks	222
Soda ash, sacks	5
Caustic soda, lb.	200
Tannathin, lb.	450
Cypan, lb.	200

Geological Data

Formation—	Depth (ft.)
Strawn	Surface to TD
Strawn sand	4,575

KMA FIELD
Wichita County, Texas

Pay zone	KMA sand
TD (avg.)	4,025 ft.

Cost Data

Footage price	$3.00
Day-work rate with drill pipe	$550.00
Day-work rate without drill pipe	$450.00

Normal Rig-Time Distribution

Days on footage rate	7
Days on day-work rate	¼
Total days (spud to rig release)	7¼

Bit Data

Total number of bits	6
Feet per bit	650

Equipment

Fuel: Diesel.
Water supply: Stock tanks.
Nearest supply center: Wichita Falls, Tex.
Terrain and roads: Rolling and caliche.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	125	120
Oil string	5½	4,025	200

Typical Mud Program

Interval, ft.	0-3,000	3,000-TD
Type mud	Water and native	Caustic-Quebracho
Weight, lb. per gal.	8.8	9.1
Filter cake, in.		2-32
Viscosity, sec.	35	45
Water loss, cc.		10-15

Mud Summary

Material—	Amount
Bentonite, tons	8
Caustic, lb.	300
Soda ash, lb.	1,200
Quebracho, lb.	200

Geological Data

Formation—	Depth (ft.)
KMA lime	3,800-3,950
KMA sand	3,950-4,050

Remarks: Pay zone (30-40 ft.) drilled with cable tools after oil string is set. Drilling time is 1½ days.

LANGSTON-KLEINER FIELD
Young County, Texas

Pay zone	Cisco
TD (avg.)	3,150 ft.

Cost Data

Footage price	$3.50
Day-work rate with drill pipe	$480.00
Day-work rate without drill pipe	$480.00

Normal Rig-Time Distribution

Days on footage rate	11¾
Days on day-work rate	½
Total days (spud to rig release)	12¼

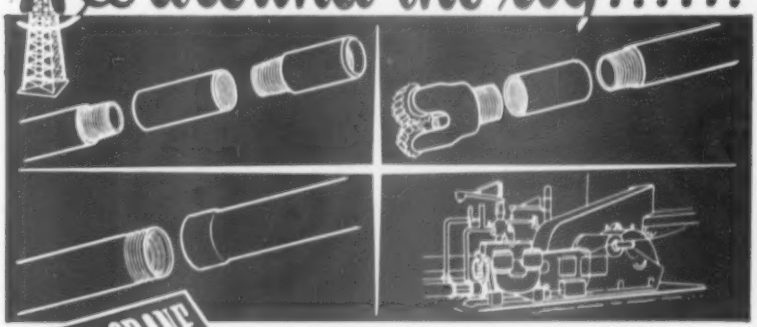
Bit Data

Total number of bits	7
Feet per bit	506

Equipment

Fuel: Butane.
Water supply: Tank.
Nearest supply center: Graham, Tex. (16 miles).

All around the rig.....



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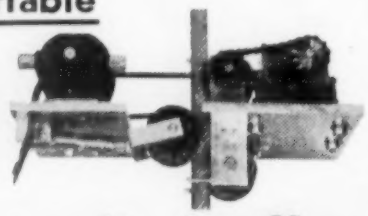

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Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	102	50
Oil string	5½	3,253	150

Mud Summary

Material—	Amount
Gel, lb.	16,300
Caustic soda, lb.	300
Soda ash, lb.	800
Monbark, lb.	250

MILES-JACKSON FIELD
Wise County, Texas

Pay zone	Atoka conglomerate
TD (avg.)	6,000 ft.

Cost Data

Footage price	$4.00-$4.25
Day-work rate with drill pipe	$750.00
Day-work rate without drill pipe	$650.00

Normal Rig-Time Distribution

Days on footage rate	21 to 25
Days on day-work rate	1 to 3 unless lost circulation
Total days (spud to rig release)	26

Bit Data

Total number of bits	21 to 23
Feet per bit	270

Equipment

Fuel: Diesel or gas.
Water supply: Hauling and water wells.
Nearest supply center: Bridgeport, Tex.
Terrain and roads: Approximately $500.00 to build roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝ to 10¾	300	150
Oil string	5½	6,000	350

Mud Summary

Material—	Amount
Gel, tons	38.3
Cottonseed hulls, tons	225
Caustic soda, lb.	2,200
Quebracho, lb.	2,200
Soda ash, lb.	1,000

Geological Data

Formation—	Depth (ft.)
Strawn	3,200-3,600
Caddo	4,000-4,600
Atoka	5,200-6,000

SHERMAN FIELD
Grayson County, Texas

Pay zone	Cordell sand
TD (avg.)	9,550 ft.

Cost Data

Footage price	$7.00
Day-work rate with drill pipe	$750.00
Day-work rate without drill pipe	$650.00

Normal Rig-Time Distribution

Days on footage rate	50
Days on day-work rate	6
Total days (spud to rig release)	56

Bit Data

Total number of bits	60
Feet per bit	150

Equipment

Fuel: Gas.
Water supply: Creek.
Nearest supply center: Sherman, 5 miles away.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	2,000	1,000
	40 lb.		6 per cent gel
Oil string	7	9,550	600
	26 and 29 lb.		4 per cent

Typical Mud Program

	0-6,000	6,000-8,500
Interval, ft.		
Type mud	Clear water	Oil base
Weight, lb. per gal.		10
Filter cake, in.		10
Viscosity, sec.		42
Water loss, cc.		9

	8,500-9,600
Interval, ft.	
Type mud	Oil base
Weight, lb. per gal.	10.6
Filter cake, in.	3
Viscosity, sec.	95
Water loss, cc.	9

Mud Summary

Aquagel, tons	52½
Soda ash, lb.	8,400
Caustic, lb.	4,600
Tannex, lb.	6,900
Carbonex, lb.	12,500
Baroid, tons	103

Geological Data

Formation—	Depth (ft.)
Baker	8,522
Davis	9,128
Cordell	9,648

Gulf Coast Has Its Offshore Problems

by Ed McGhee
District Editor

THERE has been trouble in the drilling business everywhere, but the Gulf Coast of Texas and Louisiana has all of the usual troubles and some big ones of its very own. Many of them can be lumped into the heading of offshore.

Like every other active area, the Gulf Coast saw a lot of rigs go down because of the steel strike. But, the fight between the State of Louisiana and the Supreme Court has kept a lot of additional rigs idle. Some operators managed to find enough locations in undisputed areas to keep their usual number of water rigs busy. But most couldn't. The result has been idle equipment and millions of dollars lost to both contractors and operators.

Contractors who work offshore also find in many cases that day-work rates are simply not high enough to pay off a rig as soon as they'd like. Moreover, small contractors seldom can afford to tie up the tremendous amount of capital necessary to get the offshore work.

Both on land and off, Gulf Coast wells have been setting depth records. As a sign of the deep-drilling trend, a big number of extra-heavy rigs have been put to work in the past several months. Many of them are capable of drilling to 25,000 ft. Many have electric drive.

Salt domes still . . . Salt domes still dominate Gulf Coast exploration thinking. In fact, the biggest concentration of rigs there in recent years has been working on the old Pierce Junction dome. The recent oil discovery at the Hainesville dome in East Texas is sure to help continue the salt dome as king.

Getting a rig on location is usually a problem, but contractors still like South Louisiana. They say that the closer they get to the Mississippi River, the better the drilling. Making hole is no problem anywhere on the coast, but when drilling goes too fast, the pipe often gets stuck. This doesn't seem to be the case near the delta; drillers don't have to hold up for fear of sticking.

● Texas Gulf Coast

DANBURY DOME FIELD
Brazoria County, Texas

Pay zone	Miocene sand
TD (avg.)	3,600 ft.

Cost Data

Footage price	$3.00
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	8
Days on day-work rate	3
Total days (spud to rig release)	11

Bit Data

Total number of bits	4
Feet per bit	900

Equipment

Fuel: Gas.
Water supply: Location.
Nearest supply center: Alvin.
Terrain and roads: Flat and shell.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	500	250
Oil string	5½	3,700	360

Typical Mud Program

Interval, ft.	0-3,600
Type mud	Gel
Weight, lb. per gal.	9.8
Filter cake, in.	2/32
Viscosity, sec.	48
Water loss, cc.	15

Geological Data

Formation—	Depth (ft.)
Miocene	3,600 plus

Remarks: Shallow Miocene production overlaying Danbury salt dome.

LIBERTY, SOUTH FIELD
Liberty County, Texas

Pay zone	Cook Mountain (objective)
TD (avg.)	12,000 ft. (estimated)

Cost Data

Footage price	$5.90
Day-work rate with drill pipe	$1,050.00
Day-work rate without drill pope	$900.00

Equipment

Fuel: Diesel oil.
Water supply: Water well on location.
Nearest supply center: Houston, Tex.
Terrain and roads: Low, marshy (liable to flooding).

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	2,306	1,750
Intermediate	9⅝	10,005	980
Oil string	5½ or 7	TD	

Typical Mud Program

Interval, ft.	0-10,000
Type mud	Red lime-oil emulsion
Weight, lb. per gal.	11.5
Viscosity, sec.	60
Water loss, cc.	5.8

OLIVIA FIELD
Outskirts of Olivia Townsite, Calhoun County, Texas

Pay zone	Lower 7,500-ft. sand
TD (avg.)	8,430 ft.

Cost Data

Footage price (see remarks below)	$2.90 per ft. to 5,000 ft.
Day-work rate with drill pipe	$750.00
Day-work rate without drill pipe	$675.00

Normal Rig-Time Distribution

Days on footage rate	6
Days on day-work rate	33
Total days (spud to rig release)	39

Bit Data

Total number of bits	13
Feet per bit	648 avg.

Equipment

Fuel: Diesel (contractor).
Water supply: Furnished by contractor.
Nearest supply center: Victoria, Tex.
Terrain and roads: Flat.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	1,046	500
Oil string	5½	8,430	500

Typical Mud Program

Interval, ft.	0-4,490	4,490-8,430
Type mud	Water	Lime base-oil emulsion
Weight, lb. per gal.		10.8
Filter cake, in.		2/32
Viscosity, sec.		48
Water loss, cc.		7

Remarks: 10 per cent oil emulsion with lime base.

Geological Data

Formation—	Depth (ft.)
7,500-ft. sand reservoir	7,510
7,700-ft. sand reservoir	7,690
Upper Melbourne	8,276
Lower Melbourne	8,358

Remarks: These data are for a directionally drilled hole. Field straddles Keller's Bay at arm of Matagorda Bay, and some operators prefer to drill from land if possible.

PIERCE JUNCTION FIELD
Harris County, Texas

Pay zone	Vicksburg (current objective)
TD (avg.)	7,127 ft.

Cost Data

Footage price	$3.00
Day-work rate with drill pipe	$750.00
Day-work rate without drill pipe	$675.00

Geological Data

Formation—	Depth (ft.)
First Textularis Warren 1 Vicksburg	6,559-6,590
First Clavulina SP. (abundant) Clavulina Zone Vicksburg	6,682-6,712
Suggestive of Jackson	6,986-7,018
First Marginulina Cocoaensis Jackson	7,018-7,050

● South Louisiana

ANSE LA BUTTE FIELD
St. Martin Parish, Louisiana

Pay zone	Heterostegina lime
TD (avg.)	8,200 ft.

Cost Data

Footage price	$4.25
Day-work rate with drill pipe	$900.00
Day-work rate without drill pipe	$850.00

Normal Rig-Time Distribution

Days on footage rate	20
Days on day-work rate	5
Total days (spud to rig release)	25

Bit Data

Total number of bits	16
Feet per bit	510

Equipment

Fuel: Gas.
Water supply: Wells and creeks.
Nearest supply center: Lafayette.
Terrain and roads: Slightly hilly; roads good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	16	100	150
Intermediate	10¾	1,000	1,000
Oil string	5½ or 7	8,200	500

Typical Mud Program

Interval, ft.	0-7,500	7,500-TD
Type mud	Natural	Lime
Weight, lb. per gal.	10	11-11.5
Filter cake, in.	3/32	3/32
Viscosity, sec.	40-45	40-45
Water loss, cc.	10-15	4-6

Remarks: Mud weights have to be increased rapidly below 9,000 ft. Loss circulation occurs in the Heterostegina lime section 7,800-8,500 ft.

Geological Data

Formation—	Depth (ft.)
Castille	6,500
Upper Martin	6,650
Lower Martin	7,050
Discorbis	7,700
Base of massive Miocene	7,900
Heterostegina lime	8,200

GRAND ISLE BLOCK 18 FIELD
Jefferson Parish, Louisiana

Pay zone	Miocene sands
TD (avg.)	10,000 ft.

Normal Rig-Time Distribution

Days on footage rate	Day work only
Days on day-work rate	60
Total days (spud to rig release)	60

Bit Data

Total number of bits	30
Feet per bit	333

DRILLING . . . *REPORTS*

Equipment

Fuel: Diesel.
Water supply: Sea water for mud. Meco units on L.S.T. tender for potable water.
Nearest supply center: Leeville and Houma.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	3,000	850
Intermediate	9⅝	8,500	750
Oil string	7	10,000	1,000

Typical Mud Program

Interval, ft.	0-3,000	3,000-TD
Type mud	Natural-sea water	Alkaline Tannate-sea water*
Weight, lb. per gal.	10.0	10.0
Filter cake, in.	3/32	2/32
Viscosity, sec.	40-45	40-45
Water loss, cc.	25.0	10.0

*Oil emulsion-C.M.C. used for filtration control.

Mud Summary

Material—	Amount
Clay, tons	15
Gel, tons	10
Caustic, lb.	15,000
Quebracho, lb.	10,000
C.M.C., lb.	5,000
Diesel oil, bbl.	650

Geological Data

Formation—	Depth (ft.)
Truncated Miocene sands on southeast flank of dome	8,000-10,000

Remarks: These wells are directionally drilled from multiple-well platforms with L.S.T.-type tenders.

● Ark.-La.-Tex.

GREENWOOD-WASKOM FIELD
Caddo Parish, Louisiana

Pay zone	D sand of Cotton Valley series
TD (avg.)	8,600 ft.

Cost Data

Footage price	$7.00
Day-work rate with drill pipe	$850.00
Day-work rate without drill pipe	$750.00

Normal Rig-Time Distribution

Days on footage rate	49
Days on day-work rate	7
Total days (spud to rig release)	56

Bit Data

Total number of bits	61
Feet per bit	143

Equipment

Fuel: Butane or diesel.
Water supply: Water well or nearby streams.
Nearest supply center: Shreveport, La.
Terrain and roads: Slightly rolling terrain; gravel or board roads to location off paved highways.

Casing Program

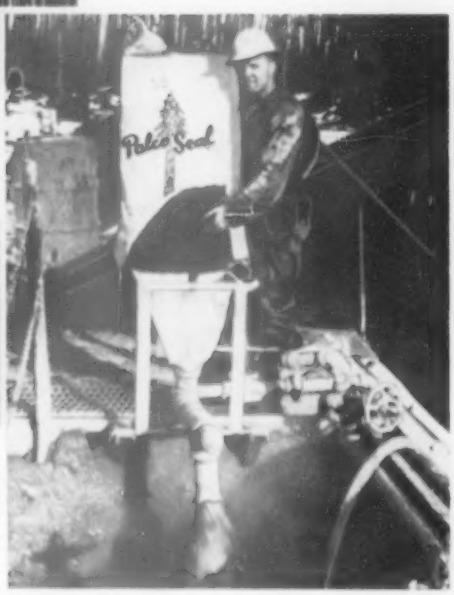
	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	1,320	600
Oil string	5½	8,738	500

Typical Mud Program

Interval, ft.	0-2,600	2,600-4,600
Type mud	Water	Natural quebracho, Driscose

On drilling locations in the "Bush" northwest of Alberta's Rocky Mountain House, *Palco Seal* is a familiar sight.

East of Peace River, too, *Palco Seal* is depended upon to control mud losses — through months when crews are snowed in.



Where it's got to be right the first time—you'll find *Palco Seal*® on the job

In Canada's remote "Bush Country," equipment and supplies come in the hard way. Because of the muskeg, trucks can only move to most of the locations during the late fall and winter when the ground and swamp are frozen. During winter, blizzards cut communications for days at a time. If a well is not completed before the "spring break-up," which may last for several weeks, the only means of transportation for personnel may be by horse, and movement of supplies to a rig is practically impossible.

Therefore, it's natural that they lay in plenty of *Palco Seal*, proved through 20 years for effective control of mud circulation losses.

You'll find *Palco Seal* on remote drilling locations from South America to the Middle East, as well as in every producing area of the U.S.A. It's easy to handle, mixes readily with mud, disperses thoroughly, remains in suspension, and pumps easily. *Palco Seal* is made up of just the right combination of slender and chunky fibers to caulk up porous or thief formations with a dense cross-hatch matting seal that's resistant to rot or decay. It will pay you to keep *Palco Seal* on hand.

For more effective low-cost control of viscosity, gel strength and water loss, use PALCOTAN®

Substantially lower in cost than other additives, *Palcotan* is proved for high efficiency, especially at low concentration. It exceeds specifications for quebracho in many applications, is readily soluble in cold water, can be added with or without caustic. *Palcotan* is a stable compound not affected by atmospheric conditions, available as a coarse non-toxic powder in convenient 50-lb. multiwall paper bags. Write for full information.

Now available in loose-filled 40-lb. bags for easy handling. Also available in 80-lb. bales.

WRITE FOR BULLETIN No. 4-02 describing the properties, operating advantages, and composition of Palco Seal.

Available through oil field and mud service organizations.

DEVELOPED THROUGH PALCO RESEARCH

THE PACIFIC LUMBER COMPANY

100 Bush Street, San Francisco 4, California

Weight, lb. per gal.	9.7
Viscosity, sec.	32
Interval, ft.	4,600-8,800
Type mud	Natural quebracho, Driscose
Weight, lb. per gal.	10.8-11
Filter cake, in.	2/32
Viscosity, sec.	40
Water loss, cc.	9.8

Mud Summary

Material—	Amount (sacks)
Magcogel	62
High yield clay	22
Quebracho	103
Caustic soda	68
Cement	100
Driscose	39
Kembreak	75
Magcobar	535

Geological Data

Formation—	Depth (ft.)
Top Saratoga chalk	2,305
Base Annana chalk	2,460
Massive anhydrite	4,590-4,850
Top Sligo	5,675
Top Travis Peak	6,050
Top Cotton Valley	8,190

HAYNES FIELD
Cass and Marion Counties, Texas

Pay zone	Mitchell (Rodessa)
TD (avg.)	6,000 ft.

Cost Data

Footage price	$4.00
Day-work rate with drill pipe	$750.00
Day-work rate without drill pipe	$650.00

Normal Rig-Time Distribution

Days on footage rate	20
Days on day-work rate	2
Total days (spud to rig release)	25

Bit Data

Total number of bits	12
Feet per bit	500-600

Equipment

Fuel: Butane.
Water supply: Shallow wells at 150 ft.
Nearest supply center: Rodessa, La.
Terrain and roads: Timberland; good highway, some marsh locations.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	650-700	Circulate
Oil string	5½	6,050	300

Typical Mud Program

Interval, ft.	0-5,000	5,000-TD
Type mud	Water	Water base
Weight, lb. per gal.	10	10.2
Filter cake, in.		2/32
Viscosity, sec.		35-43
Water loss, cc.		10

Mud Summary

Material—	Amount
Caustic, lb.	900
Quebracho, lb.	900
Driscose, lb.	500
Gel, lb.	1,500

Geological Data

Formation—	Depth (ft.)
Navarro	1,600
Pecan Gap	2,500
Pawxy	3,600
Upper Glen Rose	4,800
Upper Anhydrite	5,200
Lower Anhydrite	5,850
Hill sand	5,900
Gloyd	5,950
Mitchell	6,000

Remarks: Easy digging through most of the section, except for anhydrite stringers from 5,200-5,850 ft., which drills at 130 ft. per day.

RED ROCK, EAST FIELD
Webster Parish, Louisiana

Pay zone	Smackover
TD (avg.)	11,100 ft.

Normal Rig-Time Distribution

Days on footage rate	88
Days on day-work rate	12
Total days (spud to rig release)	100

Bit Data

Total number of bits	93
Feet per bit	110

Equipment

Fuel: Natural gas or diesel.
Water supply: Wells.
Nearest supply center: Haynesville, La.
Terrain and roads: Terrain moderately hilly; good gravel roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	16	160	250
Intermediate	10¾	2,600	1,800
Oil string	5½	11,100	500

Typical Mud Program

Interval, ft.	0-4,700	4,700-6,000	6,000-11,100
Type mud	Sodium base	Sodium base	Oil emulsion (10-12 per cent)
Weight, lb. per gal.	9-9.5	10-10.5	10.5-12.5
Filter cake, in.		2/32	2/32
Viscosity, sec.	35-40	40-45	40-50
Water loss, cc.		10-15	5-15

Mud Summary

Material—	Amount (lb.)
Quebracho	17,250
Caustic soda	11,600
Soda ash	1,800
Gel	60,900
Weighting material	354,600
Barium carbonate	10,000
Viscosity reducing agent	1,700
Lime	900
Oil, bbl.	380

Geological Data

Formation—	Depth (ft.)
Saratoga	2,270
Base Annona	2,590
Top massive anhydrite	4,395
Base massive anhydrite	4,610
Cotton Valley	7,650
Base Bossier shale	9,950
Buckner	10,560
Smackover	10,880

• Oklahoma

CHEROKEE TREND
Grant-Alfalfa Counties, Oklahoma

Pay zone	Cherokee
TD (avg.)	4,900 ft.

Cost Data

Footage price	$3.50
Day-work rate with drill pipe	$725.00
Day-work rate without drill pipe	$675.00

Normal Rig-Time Distribution

Days on footage rate	14
Days on day-work rate	1
Total days (spud to rig release)	15

Bit Data

Total number of bits	17

Equipment

Fuel: Diesel.
Water supply: Ponds or from city of Wakita.
Nearest supply center: Blackwell, Okla.
Terrain and roads: Sandy.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾-9⅝	250	200
Oil string	5½	4,900	200

Typical Mud Program

Interval, ft.	0-3,500	3,500-4,000
Type mud	Water	Salt gel and oil
Weight, lb. per gal.		9.6
Filter cake, in.		4/32
Viscosity, sec.		36-40
Water loss, cc.		25
Interval, ft.		4,600-4,900 or TD
Type mud		Salt gel and starch
Weight, lb. per gal.		9.8
Filter cake, in.		2/32
Viscosity, sec.		48-50
Water loss, cc.		12-15

Remarks: 100 bbl. oil added at approximately 3,800 ft.

EOLA FIELD
Garvin County, Oklahoma

Pay zone	Oil Creek sand
TD (avg.)	10,200 ft.

Cost Data

Footage price	$17.00
Day-work rate with drill pipe	*$940.00
Day-work rate without drill pipe	$940.00

*Plus 1½ cents per foot drill-pipe rental (4½-in.).

Normal Rig-Time Distribution

Days on footage rate	90
Days on day-work rate (wells drilled on day work)	127
Total days (spud to rig release)	100-127

Bit Data

Total number of bits	122
Feet per bit	83 avg.

Equipment

Fuel: Natural gas-field supply.
Water supply: Wells in field.
Nearest supply center: Elmore City, Okla.
Terrain and roads: Roads—gravel and oiled.

Casing program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Conductor	20	50	
Surface	13⅜	1,500	1,500
Intermediate*	7⅝	8,500	1,000
Oil string	7	10,200	†1,500

*Intermediate string not set on all wells. †Stage cementing tool set at approximately 7,000 ft. with half cement staged.

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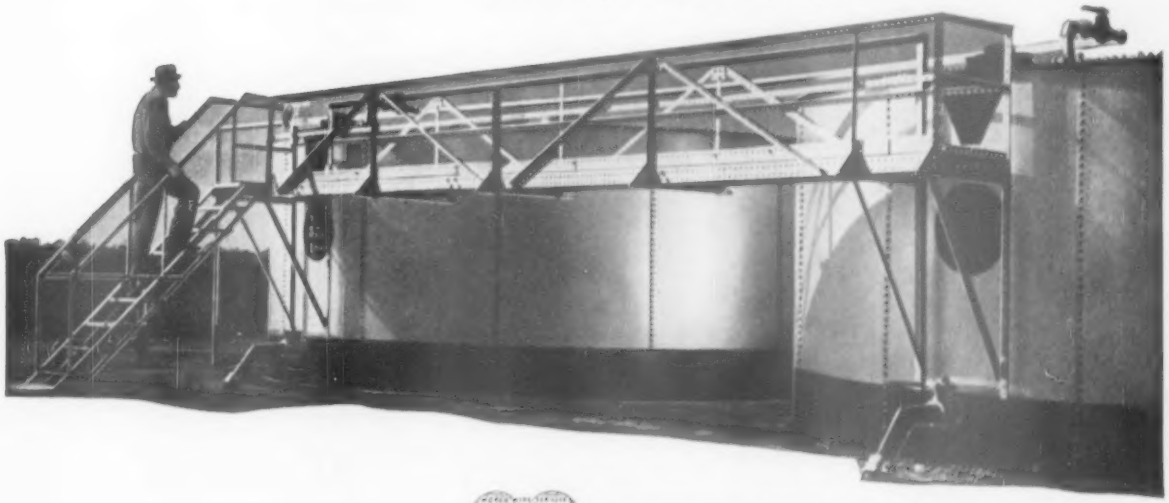

UNION

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Typical Mud Program

Interval, ft.	2,500-10,400
Type mud	Oil emulsion
Weight, lb. per gal.	10.2
Filter cake, in.	2/32
Viscosity, sec.	110 to 216
Water loss, cc.	3.2

Mud Summary

Material—	Amount
Gel, sacks	1,857
Barite, sacks	2,012
Caustic soda, lb.	9,400
Tannex, lb.	18,000
Quebracho, lb.	7,400
Soda ash, lb.	1,500
Mica, lb.	0-2,400
Fiber, lb.	0-80

Geological Data

Formation—	Depth (ft.)
Pontotoc	2,750
Woodford	6,778
Hunton	7,036
Viola	7,848
Upper Bromide sand	8,701
Basal Bromide sand	8,855
Upper McLish sand	9,048
Basal Oil Creek sand	10,066
Joins	10,211

Remarks: Drilling at Eola is rugged because of the complex geology and steep dips. Principal problem is keeping the hole straight, although occasionally lost circulation does occur.

FALLS, NORTHEAST FIELD
Cleveland County, Oklahoma

Pay zone	Second Wilcox sand
TD (avg.)	7,200 ft.

Cost Data

Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$550.00

Normal Rig-Time Distribution

Days on footage rate	20
Days on day-work rate	2
Total days (spud to rig release)	25

Bit Data

Total number of bits	25-35

Equipment

Fuel: Natural gas.
Water supply: River.
Nearest supply center: Oklahoma City, 26 miles.
Terrain and roads: Hilly, slippery when wet, undesirable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	560-600	500 Pozmix
Oil string	5½	7,100-7,200	300 Pozmix

Remarks: Circulate surface. 1,000-ft. fillup on long string.

Typical Mud Program

Interval, ft.	0-5,000	5,000-TD
Type mud	Clear water	Oil emulsion
Weight, lb. per gal.		10.0
Filter cake, in.		2/32
Viscosity, sec.		60-70
Water loss, cc.		2.5-5

Mud Summary

Material—	Amount
Aquagel	$742.50
Baroid	105.59
Carbonox	125.00
Caustic soda	51.00
Soda ash	49.50
Total	$1,073.59

Geological Data

Formation—	Depth (ft.)
Pawhuska lime	3,025
Avant lime	4,938
Hogshooter lime	5,115
Hunton lime	6,434
Sylvan shale	6,714
Viola lime	6,817
Bromide dense	7,040
Second Wilcox sand	7,127

HUGOTON (DEEP) FIELD
Texas County, Oklahoma

Pay zone	Morrow
TD (avg.)	6,812 ft.

Cost Data

Footage price	$5.00
Day-work rate with drill pipe	$600.00
Day-work rate without drill pipe	$480.00

Normal Rig-Time Distribution

Days on footage rate	29
Days on day-work rate	4
Total days (spud to rig release)	33

Bit Data

Total number of bits	23
Feet per bit	296

Equipment

Fuel: Diesel.
Water supply: Water wells.
Nearest supply center: Liberal, Kans.
Terrain and roads: Level.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	528	500 Pozmix
Intermediate	8⅝	2,813	500 Pozmix
Oil string	5½	6,351	300 Pozmix

Typical Mud Program

Interval, ft.	2,800-3,600	4,500-5,600
Type mud	Chemical	Chemical
Weight, lb. per gal.	9.1	9.2
Filter cake, in.	2/32	2/32
Viscosity, sec.	37	45
Water loss, cc.	10-15	10-12

Interval, ft.	5,600-6,300
Type mud	Chemical
Weight, lb. per gal.	9.0
Filter cake, in.	2/32
Viscosity, sec.	48
Water loss, cc.	6-8

Mud Summary

Material—	Amount
Gel, lb.	102,800
Cottonseed hulls	47,200
Soda ash, lb.	5,300
Aace lignite, lb.	7,750
Caustic soda, lb.	5,100
Preservative, lb.	400
Rock wool, lb.	1,280
Aace fiber, lb.	30,680
Gel flake, lb.	800
Hog hair, lb.	240

Geological Data

Formation—	Depth (ft.)
Heebner	4,346
Toronto	4,376
Lansing	4,528
Marmaton	5,450
Cherokee	5,784
Morrow shale	6,198
Morrow sandstone	6,282
Lower Morrow sandstone	6,515
Mississippian	6,688

MADILL, NORTH FIELD
Marshall County, Oklahoma

Pay zone	Bromide
TD (avg.)	6,535 ft.

Cost Data

Footage price	$9.50
Day-work rate with drill pipe	$750.00
Day-work rate without drill pipe	$650.00

Normal Rig-Time Distribution

Days on footage rate	60
Days on day-work rate	3
Total days (spud to rig release)	63

Bit Data

Total number of bits	53 (9-in.)
Feet per bit	106

Equipment

Fuel: Natural gas and butane.
Water supply: Ponds.
Nearest supply center: Madill.
Terrain and roads: Flat and good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	16	65	125
Intermediate	10¾	1,510	760
Oil string	7	6,535	310

Typical Mud Program

Interval, ft.	65-6,525
Type mud	(See remarks)
Weight, lb. per gal.	10
Filter cake, in.	2/32
Viscosity, sec.	115-175
Water loss, cc.	1.4-2.4

Remarks: Chemically treated fresh water bentonite with about 9 per cent crude oil added.

Mud Summary

Material—	Amount
Bentonite, tons	60
Caustic soda, lb.	3,000
Quebracho, lb.	14,000
Soda ash, lb.	700
Sodium bicarbonate, lb.	1,500
Crude oil, per cent	8-10

Remarks: Lost-circulation material may be needed.

Geological Data

	Depth (ft.)
Sycamore	4,160
Viola	5,010
First Bromide sand	5,950
Second Bromide sand	6,130
Third Bromide sand	6,245
McLish sand	6,735
Oil Creek sand	7,630

LAVERNE FIELD
Harper County, Oklahoma

Pay zone	Hoover, Tonkawa, Morrow
TD (avg.)	4,200-5,500-7,000 ft.

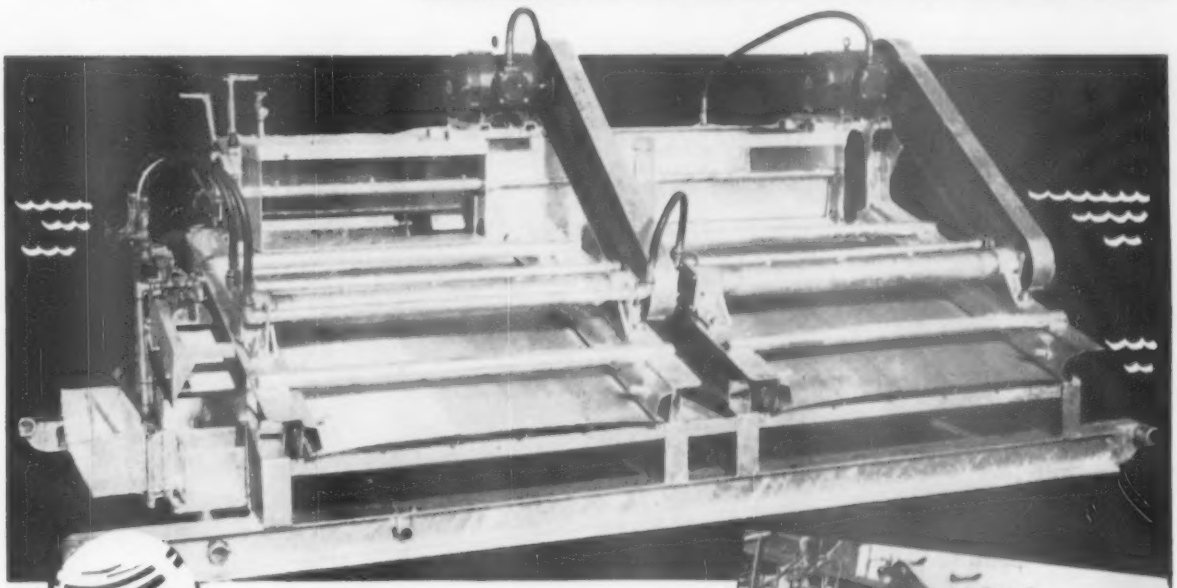
Cost Data

Footage price	$5.75
Day-work rate with drill pipe	$720.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	30
Days on day-work rate	5
Total days (spud to rig release)	35

Thompson DOUBLE VIBRATING SHALE SHAKER . . . .



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The THOMPSON DOUBLE VIBRATING SHALE SHAKER is specially engineered for off-shore barges or islands, deep wells, or wells using big volume and high pressure mud pumps. It is available either plain or *galvanized*, which makes it rust and deterioration-proof on off-shore or coastal duty.

THOMPSON Shakers are famous for their highly efficient service at any depth or flow and for their economical first cost. Very effective for removing shale and abrasives from mud, prolonging drilling tool life, and general cutting down of drilling expense. The THOMPSON Shale Shakers are easily transported and installed, using either electric, steam, gas engine or oil drive.

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SOLD ONLY THROUGH SUPPLY STORES

Above is a front view of the THOMPSON TWIN SHAKER, which is equipped with lifting bails for easy pick-up, heavy screen beds, stationary water spray, and built-in mud box.

On the rear of the shaker is the wash basin, and tool cabinet. On the left is the famous Thompson SAMPLE MACHINE which gives the operator an important foot-by-foot sample of cuttings.

Thompson TOOL CO.
IOWA PARK, TEXAS

Bit Data

Total number of bits	36
Feet per bit	200

Equipment

Fuel: L.P.G. and natural gas.
Water supply: Beaver River.
Terrain and roads: Rolling; dirt.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Conductor	20	130	300
Surface	13⅜	500	500
Intermediate	9⅝	3,000	250
Oil string	5½	7,000	300

Typical Mud Program

Interval, ft.	0-3,000	3,000-5,000
Type mud	Salt gel	Bentonite
Weight, lb. per gal.		9.0
Viscosity, sec.		40
Water loss, cc.		15
Interval, ft.		5,000-TD
Type mud		Oil emulsion
Weight, lb. per gal.		9.5
Viscosity, sec.		50
Water loss, cc.		6

Mud Summary

Material—	Amount
Gel, tons	45
Lost circulating material, lb.	25,000
Caustic, lb.	2,800
Quebracho, lb.	7,500
Oil, bbl.	250

Geological Data

Formation—	Depth (ft.)
Hoover sand	4,200
Tonkawa sand	5,500
Morrow sand	7,200

SHORT JUNCTION FIELD
Cleveland County, Oklahoma

Pay zone	Bois D'Arc section of Hunton limestone
TD (avg.)	8,200 ft.

Cost Data

Footage price	$4.00
Day-work rate with drill pipe	$650.00
Day-work rate without drill pipe	$600.00

Normal Rig-Time Distribution

Days on footage rate	20
Days on day-work rate	5
Total days (spud to rig release)	25

Bit Data

Total number of bits	29
Feet per bit	282

Equipment

Fuel: Gas.
Nearest supply center: Oklahoma City, Okla.
Terrain and roads: Level farm lands.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	850	350 (Pozmix)
Oil string	5½	8,200	350

Mud Summary

Material—	Amount
Bentonite, sacks	578
Caustic soda, sacks	12
Tannate, sacks	75
Soda ash, sacks	13
Fibrous lost circ. mat., sacks	15
Mica, sacks	17
Cost material	$1,884
Trucking and tax	180
Total mud bill	$2,064

Geological Data

Formation—	Depth (ft.)
Oswego lime marker	7,500
Prue sand	7,530
Verdigris lime	7,600
Pink lime	7,750
Bartlesville sand	7,800
Unconformity sand	7,900
Bois D'Arc section	7,950

Remarks—Mud Program:

1. **Surface hole.** Drilled with water or gel and water.
2. **Below surface hole to mudup depth.** Native mud is used to drill with as long as hole conditions permit. Mud weight is kept at 10 lb. per gal. or less and viscosity at 32-35 seconds. Mudup depth generally varies from 4,500 to 6,500 ft.
3. **Mudup depth.** All pits are thoroughly cleaned and mud weight is reduced to 9.3 to 9.5 lb. per gal. with water. Gel, caustic soda, and liguin or quebracho are added as required. Crude oil 6 to 12 per cent in volume is added and maintained in the mud system.

Weight. Maintained to 9.6 to 9.8 lb. per gal. to total depth.
Viscosity. Increased gradually with drilling depth to maximum of 100 seconds.
Fluid loss. Reduced gradually to 6-8 cc. by 7,600 ft. and reduced to 5 cc. by time top of Bois D'Arc pay zone is encountered.
Gel strength. Maintained at 0 initial, 10 minutes 4-12.
Lost-circulation material is kept on hand at all times, and pretreatment in moderate amounts is made to mud system approximately 100 ft. above Bois D'Arc section.

● Kansas

HOLLEY FIELD
Graham County, Kansas

Pay zone	Lansing-Kansas City
TD (avg.)	4,000 ft.

Cost Data

Footage price	$3.00
Day-work rate with drill pipe	$550.00

Normal Rig-Time Distribution

Days on footage rate	9
Days on day-work rate	1
Total days (spud to rig release)	10

Bit Data

Total number of bits	9
Feet per bit	440

Equipment

Fuel: Diesel.
Water supply: Local hauling at about $500.00 per well.
Nearest supply center: Hill City, 20 miles.
Terrain and roads: Good; hard surface.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	200	115
Oil string	5½	3,990	125

Typical Mud Program

Remarks: Mud will not exceed $500.00 for a normal well.

Geological Data

Formation—	Depth (ft.)
Anhydrite	2,100
Lansing-Kansas City	3,720

INTERSTATE FIELD
Morton County, Kansas

Pay zone	Upper Morrow
TD (avg.)	4,650 ft.

Cost Data

Footage price	$3.45
Day-work rate with drill pipe	$480.00
Day-work rate without drill pipe	$400.00

Normal Rig-Time Distribution

Days on footage rate	34
Days on day-work rate	3
Total days (spud to rig release)	37

Bit Data

Total number of bits	20
Feet per bit	232

Equipment

Fuel: Diesel.
Water supply: Water wells.
Nearest supply center: Liberal, Kans.
Terrain and roads: Cimarron River bottom, sandy and rough.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13	99	200
Intermediate	8⅝	1,242	600
Oil string	4½	4,247	600

Remarks: Due to water gravel near surface, it is necessary to run conductor pipe.

Typical Mud Program

Interval, ft.	3,600-4,000	4,000-4,400
Type mud	Chemical	Chemical
Weight, lb. per gal.	9.6	9.6
Filter cake, in.	2/32	2/32
Viscosity, sec.	41	41
Water loss, cc.	9-14	8-12
Interval, ft.		4,400-4,650
Type mud		Chemical
Weight, lb. per gal.		9.7
Filter cake, in.		2/32
Viscosity, sec.		47
Water loss, cc.		7-10

Mud Summary

Material—	Amount (lb.)
National gel	50,700
Brine mud	2,500
Barite	3,900
Carbathin	250
Caustathin	750
Caustic soda	2,400
Soda ash	3,600
Cottonseed hulls	755
Fiber	5,640
Lime	150
Cedar seal	760

Geological Data

Formation—	Depth (ft.)
Wabaunsee	2,460
Topeka	2,654
Lansing	3,102
Cherokee	3,834
Morrow shale	4,091
Upper Morrow sandstone	4,136
"G" Morrow sandstone	4,426
Keys	4,485
Mississippian	4,641

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LARNED FIELD
Pawnee County, Kansas

Pay zone	Arbuckle
TD (avg.)	3,867 ft.

Cost Data

Footage price	$3.15
Day-work rate with drill pipe	$550.00

Normal Rig-Time Distribution

Days on footage rate	8⅓
Days on day-work rate	1½
Total days (spud to rig release)	10½

Bit Data

Total number of bits	10
Feet per bit	387

Equipment

Fuel: Gas.
Water supply: Larned.
Nearest supply center: Great Bend.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	981	425
Oil string	5½	3,867	125

Typical Mud Program

Remarks: Average mud bill is $650.00. Oil is added in some wells.

Geological Data

Formation—	Depth (ft.)
Anhydrite	975
Heebner	3,397
Brown lime	3,498
Lansing	3,508
Arbuckle	3,833

• California

BANDINI FIELD
East Los Angeles County

Pay zone	Nordstrom
TD (avg.)	5,890 ft.

Cost Data

Day-work rate with drill pipe per hour	$41.00
Day-work rate without drill pipe per hour	$35.00

Normal Rig-Time Distribution

Days on day-work rate	26
Total days (spud to rig release)	26

Bit Data

	Bits	Core heads
Total number of bits	19	2
Feet per bit	298	200

Equipment

Fuel: Diesel.
Water supply: Private water company.
Nearest supply center: Los Angeles.
Terrain and roads: Paved.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	1,050	800
Intermediate	8⅝	5,725	700
Oil string	6⅝	5,890 top 5,700	

Typical Mud Program

Interval, ft.	0-3,000	3,000-TD
Type mud	Clay base	Oil emulsion
Weight, lb. per gal.	72-85	75-85
Filter cake, in.	1/32	1/32
Viscosity, sec.	40-70	40-80
Water loss, cc.	2.5-8.0	2.0-6.0

Mud Summary

Material—	Amount
Aquagel, tons	6
Quebracho, sacks	100
Barafas, sacks	30
Caustic soda, drums	12
Crude oil, bbl.	150

Geological Data

Formation—	Depth (ft.)
Upper Pico	800-1,400
Middle Pico	1,400-3,100
Lower Pico	3,100-3,600
Repetto	3,600

Remarks: All holes have been directionally drilled.

SANTA FE SPRINGS FIELD
East Los Angeles Basin

Pay zone	Santa Fe
TD (avg.)	9,100 ft.

Cost Data

Footage price	$7.00-$8.00
Day-work rate with drill pipe	$720.00
Day-work rate without drill pipe	$675.00

Normal Rig-Time Distribution

Days on footage rate	45
Days on day-work rate	15
Total days (spud to rig release)	60

Bit Data

Total number of bits	40 and 4 hole openers
Feet per bit	202

Equipment

Fuel: Natural gas from field.
Water supply: Field.
Nearest supply center: Surrounded by supply houses.
Terrain and roads: Excellent roads, level terrain.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	18⅝	350	350
Intermediate	11¾	4,200	400
Oil string	7	8,400	400

Remarks: 750 ft. of 5-in. liner.

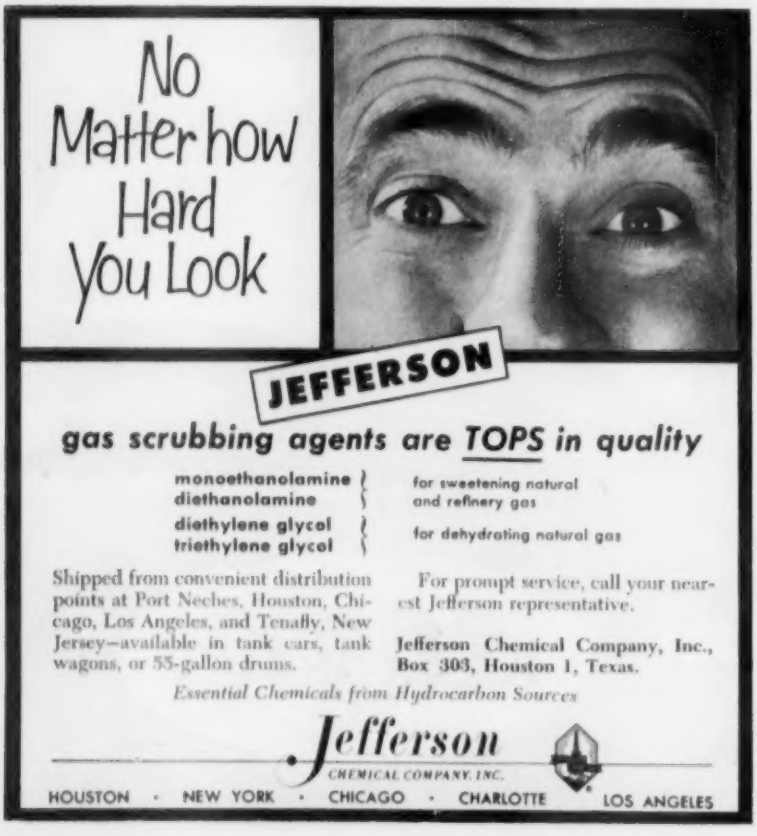
Typical Mud Program

Interval, ft.	0-TD
Type mud	Fresh water clay and oil emulsion
Weight, lb. per gal.	67-70
Filter cake, in.	3/32
Viscosity, sec.	40-45 A.P.I. funnel test
Water loss, cc.	(See remarks below)

Remarks: Less than 10 cc. in 15 minutes above 4,200 ft.; less than 5 cc. in 15 minutes, 4,200-7,000 ft.; less than 3 cc. in 15 minutes below 7,000 ft.

Geological Data

Formation—	Depth (ft.)
Gas zone	2,160
Foix	3,440
Bell	3,670
Meyer	4,150
Nordstrom	4,905
Buckbee	5,515
O'Connell	6,220
Clark	7,250
Hathaway	8,000
Santa Fe	9,100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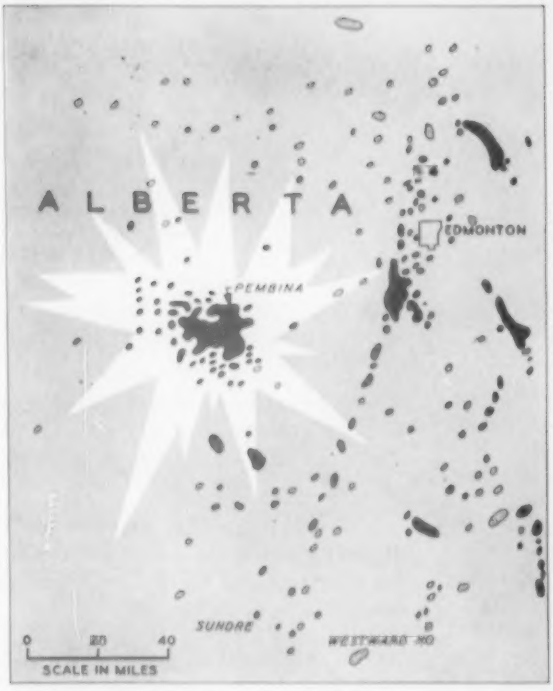
A PIPELINE OUTLET has given Saskatchewan a market for its oil. The result has been a rapid and highly successful drilling campaign that has not yet reached its peak.



SPRAWLING PEMBINA with its 400,000 acres is the hub of Canadian drilling. At least one-sixth of the total rigs in Canada are busy developing the Cardium sand in this field.

Canadian Drilling Shows 20 Per Cent Increase

DEMAND for rigs in southeastern Saskatchewan and in Pembina has made 1956 a banner year for Canadian contractors. A midsummer survey showed 304 rigs turning to the right. This is an increase of 20 per cent over the number active a year ago.

The two most active areas, Pembina and southeastern Saskatchewan, will keep more than one-third of the Canadian rigs busy for the next 12 months. Canadian oil companies are shifting slightly from an emphasis on exploratory drilling to one on development drilling. This may affect the number of wildcats drilled during the year, making the total for 1956 less than originally forecast. However, the wildcatting will be on a par with the 1955 figure. Over-all, total number of wells should be above the 1955 figure of 2,879 wells; and some estimates claim the 1956 grand total will exceed last year's by 10 per cent.

Southeastern Saskatchewan . . . A pipeline outlet, increased price of crude, and high exploratory success ratio make southeastern Saskatchewan the busiest drilling area in Canada, except for Pembina. Another factor that has accelerated drilling has been short-term acreage and top-leasing. July saw 120 completions in the province with 96 successful and 24 dry holes. Wildcats for the month enjoyed a success ratio of 33 per cent.

Apart from the climate, drilling conditions in Saskatchewan are fairly easy. Production occurs at 4,500-5,000 ft. in most of the fields and operations are out in the plains and not slowed down by the muskeg.

COLEVILLE FIELD
Saskatchewan, Canada

Pay zone	Banff sand
TD (avg.)	2,750 ft.

Cost Data

Footage price	$2.75
Day-work rate with drill pipe	$850.00
Day-work rate without drill pipe	$720.00

Normal Rig-Time Distribution

Days on footage rate	5
Days on day-work rate	0
Total days (spud to rig release)	5

Bit Data

Total number of bits	3
Feet per bit	900

Equipment

Fuel: Diesel.
Water supply: Local (good).
Nearest supply center: Coleville.
Terrain and roads: Level country—good roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	235	175 plus 2 per cent CaCl₂
Oil string	7	2,750	180 plus 2 per cent gel

Remarks: 24 hours' waiting time on surface pipe. No waiting time on oil string.

Typical Mud Program

Interval, ft.	0-2,750
Type mud	Gel
Weight, lb. per gal.	10.7
Filter cake, in.	2/32
Viscosity, sec.	45
Water loss, cc.	3.7

Material—	Amount
Bentonite, lb.	1,000
Caustic, lb.	250
Quebracho, lb.	400

Geological Data

Formation—	Depth (ft.)
Lea Park	625
First White Specks	1,634
Second White Specks	1,921
Viking sand	2,280-2,303
Blairmore	2,445
Lodgepole	2,602
Banff sand	2,692
Exshaw	2,750

FORT ST. JOHN FIELD
N. E. British Columbia, Canada

Pay zone	Triassic "D"
TD (avg.)	4,900 ft.

Cost Data

Footage price	$15.00
Day-work rate with drill pipe per hour	$38.00
Day-work rate without drill pipe per hour	$32.00

Normal Rig-Time Distribution

Days on footage rate	25
Days on day-work rate	5
Total days (spud to rig release)	30

Bit Data

Total number of bits	40
Feet per bit	15

Equipment

Fuel: Diesel fuel.
Water supply: Local streams and lakes.
Nearest supply center: Dawson Creek, 50 miles.
Terrain and roads: Generally good.

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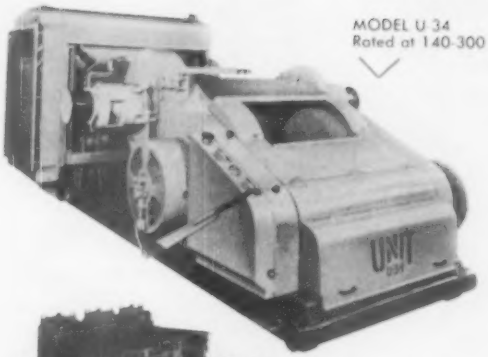
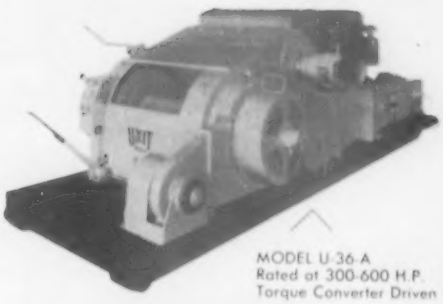
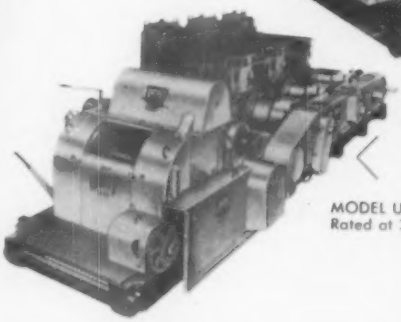


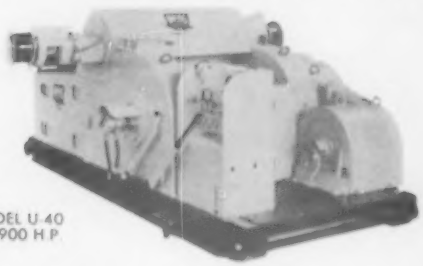
MODEL U-34
Rated at 140-300 H.P.



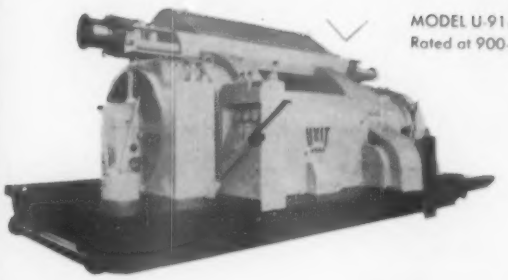
MODEL U-36-A
Rated at 300-600 H.P.
Torque Converter Driven



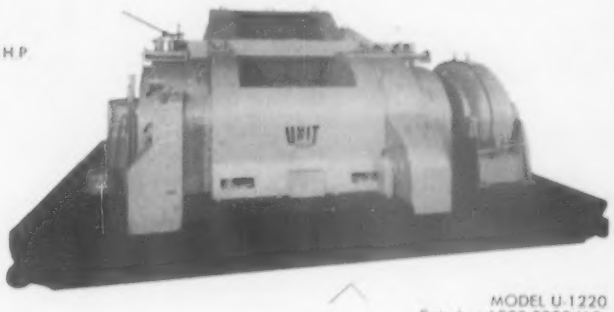
MODEL U-15
Rated at 300-600 H.P.



MODEL U-40
Rated at 600-900 H.P.

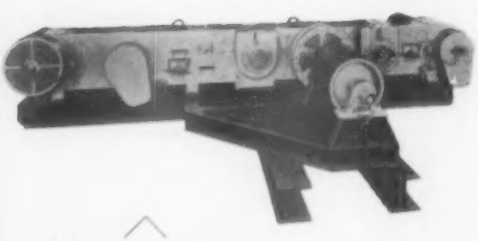


MODEL U-914-A
Rated at 900-1400 H.P.

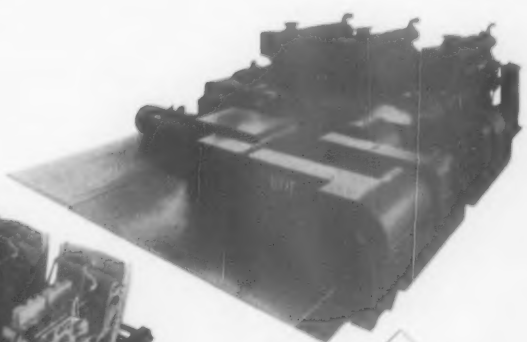


MODEL U-1220
Rated at 1200-2000 H.P.

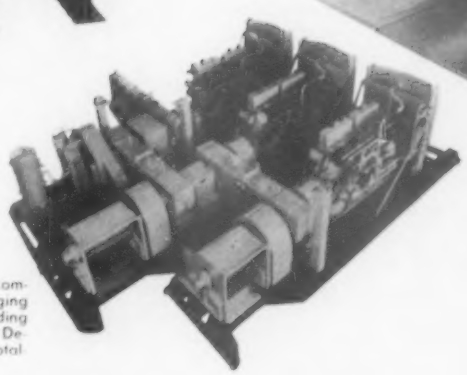
RIG *. . . designed for the job*



MODEL U-37 line compound drive unit for two or three engines totaling up to 1200 H.P.



MODEL LS-1420-A two, three or four engine compound drive unit. Two-speed pump drive available. Designed with sectional or in line compound case for a combined horsepower up to 2000.



MODEL S-612-A swinging compound drive unit with swinging final drive and compounding cases. Two pump drives. Designed for 2, 3 or 4 engines totaling up to 1200 H.P.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	618	360
Production string	7	4,900	600

Typical Mud Program

Interval, ft.	0-3,900	3,900-4,900
Type mud	Gel	Gypsum starch
Weight, lb. per gal.	9.5 to 10.5	9.5 to 10.5
Filter cake, in.	5/32	5/32
Viscosity, sec.	65-70	65-95
Water loss, cc.	5-6	2-5

Remarks: At 3,800 ft. the gel mud is converted to the gyp-starch mud to drill massive anhydrite. High pH oil emulsion has been used with good results.

Mud Summary

Material—	Amount (sacks)
Gel	420
Thinner	7
Caustic	8
Starch preservative	11
Starch	222
Soda ash	2
Bicarb	5
Plaster	83

Geological Data

Formation—	Depth (ft.)
Cadotte	3,200
Cadomin	3,600
Triassic A	3,900
Triassic B	4,000
Triassic D	4,900

Remarks: The summary given above is for a well with changeover from a gel water to a gyp-starch mud. In the 70-well program now under way about half are gel water mud at 65 cents per foot mud cost, and half are gyp starch muds at 95 cents per foot mud cost.

HARMATTAN FIELD
Alberta, Canada

Pay zone	Rundle (Mississippian)
TD (avg.)	9,170 ft.

Normal Rig-Time Distribution

Days on footage rate	42
Days on day-work rate	4
Total days (spud to rig release)	46

Bit Data

Total number of bits	55
Feet per bit	167

Equipment

Fuel: Diesel.
Water supply: Surface ponds.
Nearest supply center: Calgary.
Terrain and roads: Hilly, blacktop and gravel.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	500
Oil string	5½	9,150	400

Remarks: Oil string set through productive zone. Casing perforated for completion.

Typical Mud Program

Interval, ft.	0-600	600-TD
Type mud	Spud mud	Oil emulsion
Weight, lb. per gal.	8.9	9.0-11.0
Filter cake, in.		2/32
Viscosity, sec.	40	32-135
Water loss, cc.		9.0

DRILLING . . . REPORTS

Mud Summary

Material—	Amount (lb.)
Gel	60,000
Thinner	5,000
Caustic	2,500
Weight material*	20,000
Crude	150

*Occasionally needed.

Geological Data

Formation—	Depth (ft.)
Lea Park	5,900
Colorado	6,400
Cardium	7,150
Second White Specks	7,600
Viking	8,150
Home sand	8,800
Rundle	9,100
Rundle Porosity	9,150

PEMBINA FIELD
Alberta, Canada

Pay zone	Cardium
TD (avg.)	5,095 ft.

Cost Data

Footage price	$4.00
Day-work rate with drill pipe per hour	$33.50
Day-work rate without drill pipe per hour	$33.50

Normal Rig-Time Distribution

Days on footage rate	9¼
Days on day-work rate	1¼
Total days (spud to rig release)	10½

Bit Data

Total number of bits	11
Feet per bit	463

Equipment

Fuel: Diesel—$120.00 per day.
Water supply: $30.00 per day.
Nearest supply center: Local.
Terrain and roads: Muskeg roads—good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	240
Oil string	5½ or 7	T.D.	150

Typical Mud Program

Interval, ft.	0-600	0-2,000
Type mud	Limed Bentonite	Watered Bentonite
Weight, lb. per gal.	8.6-10	10
Filter cake, in.		2/32
Viscosity, sec.	60-120	45
Water loss, cc.	30	5

Interval, ft.	2,000-TD
Type mud	Crude emulsion
Weight, lb. per gal.	10.7-12
Filter cake, in.	2/32
Viscosity, sec.	45-65
Water loss, cc.	3.5

Mud Summary

Material—	Amount
Bentonite, sacks	15-20
Lime, lb.	100
Sawdust, sacks	10-15
Bentonite, lb.	6,000
SAPP, lb.	500
Pellite, lb.	350
Seeco-Mul, lb.	650
Jel flake, lb.	200
Lime (lb.)	50

Geological Data

Formation—	Depth (ft.)
Shale	0-3,000
Belly River sand	3,000-4,000
Cardium zone	5,000
Cardium sand	5,100

STEELMAN FIELD
Saskatchewan, Canada

Pay zone	Mississippian
TD (avg.)	4,800 ft.

Cost Data

Footage price	$4.00-$4.25
Day-work rate with drill pipe per hour	$35.00
Day-work rate without drill pipe per hour	$33.00

Normal Rig-Time Distribution

Days on footage rate	14
Days on day-work rate	6
Total days (spud to rig release)	20

Bit Data

Total number of bits	6
Feet per bit	335

Equipment

Fuel: Diesel.
Nearest supply center: Estevan.
Terrain and roads: Flat; gravel and dirt.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	600	270
Oil string	5½	4,800	250

Typical Mud Program

Interval, ft.	0-4,100	4,100-TD
Type mud	Gel	Gyp base
Weight, lb. per gal.	9.5-10	9.5-10
Filter cake, in.		2/32
Water loss, cc.		Under 7

Remarks: At 4,600 ft. normally add 80 sacks of salt.

Mud Summary

Material—	Amount (lb.)
Sodium bicarb.	400
Plaster of paris	1,000
Preservative	500
Gel	10,000
Starch	12,500
SAPP	100
Salt	8,000

Geological Data

Formation—	Depth (ft.)
Viking	3,035
Jurassic	3,644
J-4-A	4,217
Red Beds	4,428
Miss. (Charles)	4,630
Porosity	4,734
Anhydrite	4,768
Mission Canyon	4,805

VIRDEN-ROSELEA FIELD
Manitoba, Canada

Pay zone	Mississippian
TD (avg.)	2,070 ft.

DRILLING . . . *REPORTS*

Cost Data

Footage price	$3.75-$4.00
Day-work rate with drill pipe per hour	$33.00
Day-work rate without drill pipe per hour	$30.00

Normal Rig-Time Distribution

Days on footage rate	4-7
Days on day-work rate	3-4½
Total days (spud to rig release)	10

Bit Data

Total number of bits	4-6
Feet per bit	345-1,600

Equipment

Fuel: Diesel.
Water supply: Creeks and sloughs.
Nearest supply center: Virden, Man.
Terrain and roads: Flat; gravel and dirt roads, some asphalt.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	500	225
Oil string	5½	2,085	125

Typical Mud Program

Interval, ft.	0-1,750	1,750-TD
Type mud	Gel	Gyp base
Weight, lb. per gal.	9.5-10	9.5-10
Viscosity, sec.		66
Water loss, cc.		Under 7

Mud Summary

Material—	Amount (lb.)
Starch	2,000
Starch preservative	350
Plaster of paris	1,000
Phosphate	200
Gel	5,000

Geological Data

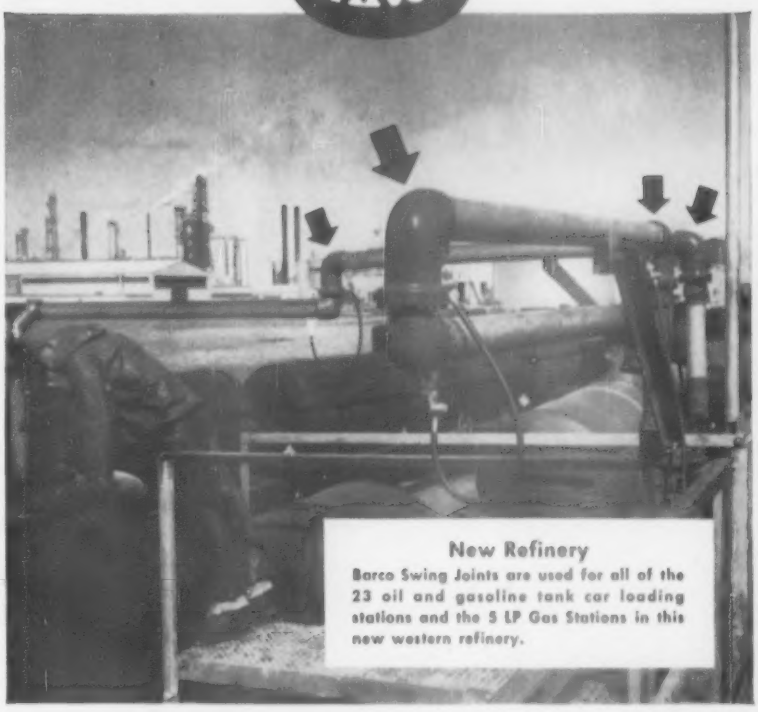
Formation—	Depth (ft.)
Viking	1,204
Swan River	1,313
Jurassic	1,481
Gyp Springs	1,827
Red Beds	1,947
Miss. (Lodgepole)	1,952
Crinoidal	2,016
Oolitic	2,042
Cherty zone	2,075

Among the Drilling Contractors

Your Journal editors are . . . so they can keep track of what's going on and pass on the information to you.

Don't overlook "Among the Drilling Contractors' . . . a weekly Journal feature designed to keep you up to date with what other contractors are doing—who is drilling where.

SWING JOINTS BARCO ASSEMBLIES



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Barco Swing Joints are used for all of the 23 oil and gasoline tank car loading stations and the 5 LP Gas Stations in this new western refinery.

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2. **Ball Bearing and O-Ring Equipped**—Designed specifically for handling gasoline, oil, lube oil, LP gas, and other fluids, including many chemicals, *without leakage.*
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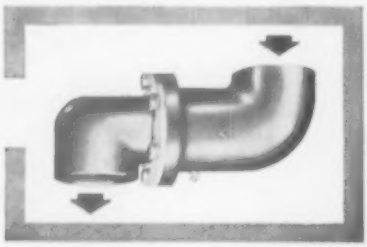

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This modification of HOUDRIFORMING—already extensively tested—gives the refiner a 3-way approach to higher octane production.

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PAINTING STEEL—6

Steel Surfaces Require Various Paint Mixtures

by J. O. Jackson* and Joseph Bigos†

THE outer coat of paint must be inert to the atmosphere in which it will be exposed, and must serve to protect the paint system from the effects of ultraviolet light and the weather. The vehicle obviously must be one which will have long durability in the environment to which it is exposed.

If this environment is a rural or marine atmosphere, then linseed oil, alkyd, or phenolic paints are adequate; but if the environment is a strong chemical one, then oleoresinous paint may be completely unsatisfactory and synthetics, such as vinyls, chlorinated rubber, or epoxys or inerts, such as bitumen, may be necessary.

Painting recommendations . . . There is no painting system suitable for an entire refinery. Because of the complex operations and many different service exposures, each area or unit must be considered separately. Most of the steel can be grouped into one of four categories, as pointed out by Freeman and Sline:[1] storage tanks, process units, yard piping, and buildings.

Broad recommendations for each group are given herein, but specific cases—even within groups—will necessitate variations due to local conditions.

Storage tanks . . . Of the four classes of surfaces, storage tanks represent the largest amount of surface area in the average refinery. Fortunately, they are rather easy to paint and inasmuch as most tanks are located in the mildest environments of the refinery, the life attained is generally satisfactory.

Because of the tremendous aggregate square footage of surface, total painting costs are large despite relatively low cost per unit of surface area. For the same reason, a slight decrease in painting cost per square foot per year amounts to significant savings.

Much has been said about painting tanks to reduce breathing losses by reducing surface temperature of the roof and shell plates. The subject has been adequately covered in a recent publication by Hoffman.[2] Suffice it to say that painting the roof and shell of volatile-product storage tanks white will substantially reduce breathing losses.

But reducing breathing losses is not enough; the over-all economics must be considered. The conventional white tank paint will not last as long as aluminum paint; therefore, the savings from reducing breathing losses must outweigh the increased repainting cost in using white paints. This aspect is nicely covered in the summary by Hoffman.

White tank paints are effective in reducing surface temperature after prolonged weathering only if they chalk. This self-cleaning process keeps reflection high and emissivity low. Aluminum, grays, dark colors, and dirt-retaining paints tend to drop lower and lower in reflectance as the time of exposure increases. Two good white paints for this purpose are:

S.S.P.C.-Paint 104, "white or tinted alkyd paint," Type 1, white:

	Per cent by weight
Pigment (±2.5 per cent)—(47.5):	
Titanium dioxide*	†67.0
Reinforcing and tinting pigment	‡33.0
	100.0
Vehicle (±2.5 per cent)—(52.5):	
Alkyd resin solids (23 per cent phthalic anhydride)	†46.8
Mineral spirits and driers	‡53.2
	100.0

*The titanium dioxide should be a blend giving the desired moderate chalking for the intended exposure. †Minimum. ‡Maximum.

A complete specification for an excellent white tank paint is that of Shell Oil Co., published by Radecke.[3] The composition is:

	Per cent by wt.	
	Min.	Max.
Pigment (34 per cent by weight, minimum):		
Titanium dioxide (rutile)	64	66
Zinc oxide	8	9
Magnesium silicate		28
Vehicle (66 per cent maximum):		
Alkyd resin solution (25 per cent phthalic anhydride, 70 per cent solids)	75	77
Mineral spirits	22	24
6 per cent cobalt drier	0.44	0.46
6 per cent calcium drier	0.53	0.55

*Pittsburgh-Des Moines Steel Co., Pittsburgh. †Senior Fellow, Mellon Institute of Industrial Research. Paper presented at A.P.I. Refinery Division meeting, Montreal, 1956.

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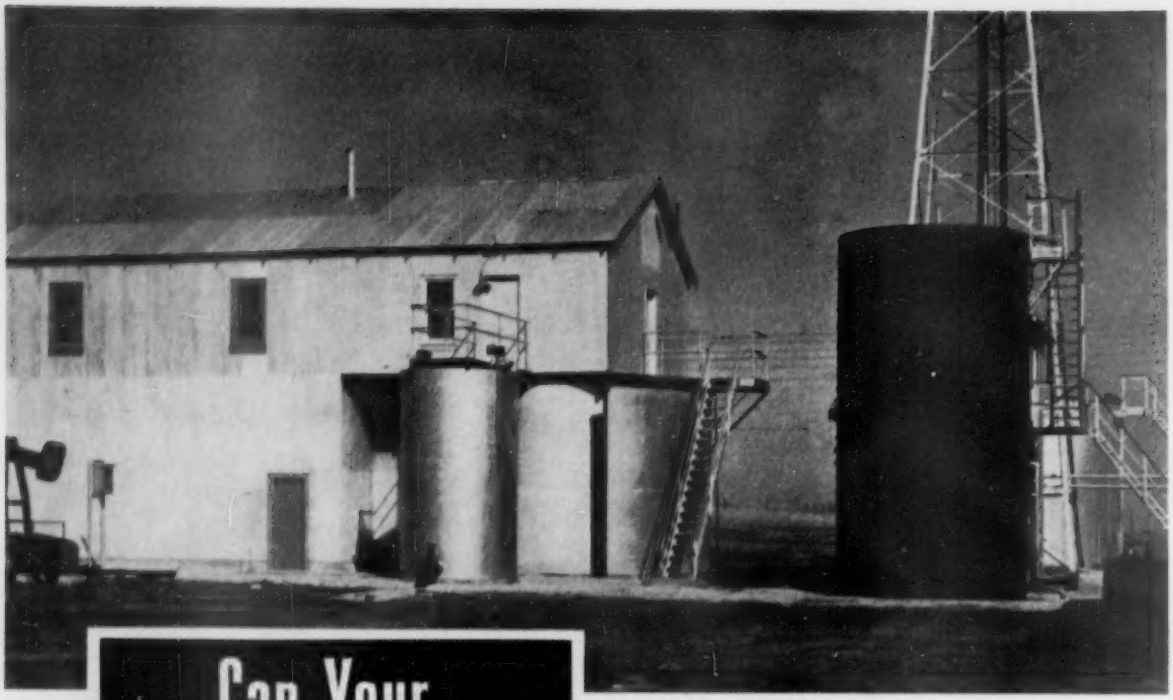
1. Freeman, R. S., and Sline, L. L., "Petroleum Refineries" Steel Structures Painting Manual, Vol. 1, Chap. 16, 1954.
2. Hoffman, E. J., "The Effect of Paint Colors in Reducing Storage Tank Losses," Proc. A.P.I. 35 (2), 1955.
3. Radecke, F., "Basic Essentials for the Reduction of Atmospheric Corrosion," Corrosion 2 (10) 39, 1955.



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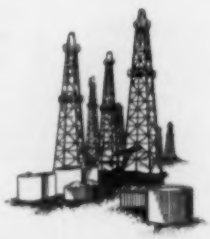

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Automation Cuts Lake Chicot Plant Costs

by E. S. Wenger

THE fourth economic factor, cost of operation, was responsible for incorporating automation in the plant design. A small gasoline plant is generally not able to support much operating labor. Considerable thought was therefore given to the application of instruments and controls to simplify plant operation and to provide safety devices that would be dependable when associated with a minimum of experienced operating labor.

The application of automation resulted in a plant operated by one man on a 40-hour work week supplemented by oil-field switchers. The switchers are instructed to shut the plant down at any time trouble develops in the absence of the regular plant operator. The responsibilities of the regular plant operator include all minor adjustments necessary to keep the components of the plant in good operating condition.

EQUIPMENT IS SUPPORTED on pilings at the Lake Chicot gasoline plant because the area is completely flooded a part of each year.

Process description . . . This is a simple, conventional absorber - still-stabilizer type of plant. Approximately 22 gal. of 200 molecular-weight oil per thousand cubic feet of gas is pumped to the absorber. After passing through a rich oil-lean-oil exchanger, the rich oil enters a direct-fired heater and then a still. The stripping medium for the still is stabilizer - accumulator overhead gas.

The net still overhead is cooled, partially condensed, and either pumped or compressed to stabilizer feed pressure. Stabilizer reboiler heat is obtained from still bottoms on the way to the rich-oil lean-oil exchanger. Still reflux is a side-stream from the stabilizer feed-pump discharge line. All cooling is done by atmospheric sections flooded with water from the bayou. The water pump is a turbine type of pump and is mounted on a steel barge. The pump was barge mounted to pick up water near the surface where the silt concentration is at a minimum.

Author is with Amerada Petroleum Corp., Tulsa. Paper presented at N.G.A.A. annual meeting, Fort Worth, 1956.

Instrumentation . . . Automation as applied to the Lake Chicot plant consists of the following controls:

1. Recording temperature controllers for the heater oil outlet, still top and stabilizer bottom temperatures.

2. Recording flow controllers on the absorption oil and on the stabilizer reflux.

3. Still pressure is controlled by a downstream type of pressure regulator on the stripping gas line. The quantity of stripping gas is thus controlled by recompressor speed.

4. The speed of the stabilizer feed pump is controlled by the liquid level in the still overhead accumulator.

5. The liquid level in the stabilizer reflux accumulator controls a motor valve on a bypass line around the stabilizer overhead cooler. A high liquid level causes an increase in accumulator temperature thus driving excess L.P.G. into the residue gas line.

6. The lean-oil storage tank is elevated and equipped to automatically maintain the oil level in the absorption cycle.

7. All engine-oil levels are controlled by automatic lube-oil feeders.

Shutdown devices . . . The plant is automatically shut down by any one of the following factors:

1. Water-pump failure.

2. High liquid level in inlet scrubber caused by excessive carry over of crude oil.

3. High liquid level in absorber.

4. High liquid level in residue scrubber caused by carry over.

In addition, numerous devices in the plant shut down individual components to prevent local damage.

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ROCK-BIT DESIGN, SELECTION, AND EVALUATION—6

Cross-Section Bit Design Shows Variable Factors

AS previously stated, the size of any given rock-bit element is simply that which, in combination with all the other elements, will function properly within a limited amount of space. This applies to cross-section bit design as well as to cone-bit design.

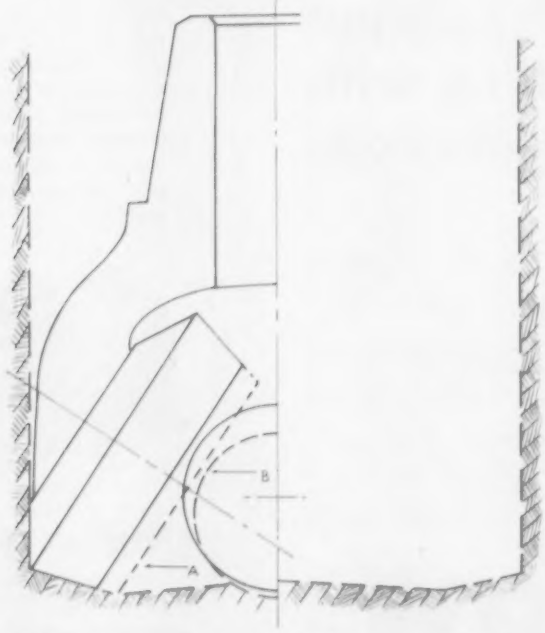
The main dissimilarity between the cross-section and cone type of design fundamentals lies in the basic bit geometry. Whereas the basic geometry of the cones, bearings, and legs is identical for a given cone bit, the geometry of the elements in a cross-section bit varies considerably. Cross-section bit gage-cutter diameters are much larger than those of the crosscutters. The length of the crosscutters, however, is much greater than that of the gage cutters.

Author is chief sales engineer, H. C. Smith Tool Co., Compton, Calif.

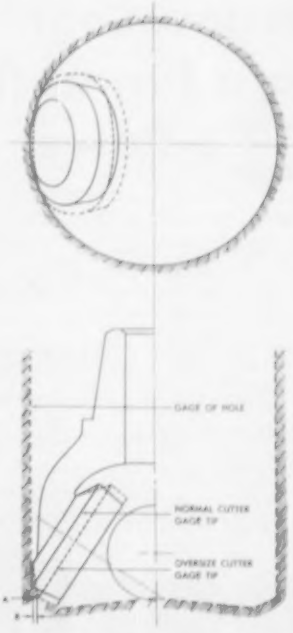
Basic cutter geometry . . . Additional dissimilarity exist between the cone and cross-section bits from the designer's viewpoint. In the design of a cone bit, any increase or decrease in the basic physical size or shape of any one cone affects the remaining cones in exactly the same manner. Usually, however, changes in the physical size or shape of either set of cross-section cutters affect the other set in a reverse manner. This effect is best illustrated by Fig. 12.

For this example the gage cutter and crosscutter of a given design are represented by solid lines. The dash line A indicates a contemplated increase in the gage-cutter thickness. It is evident that this increase in gage-cutter thickness can result only in a decrease in the diameter B of the crosscutter. Similarly, it becomes apparent that any increase in crosscutter diameter can be acomplished only by a reduction in the thickness of the gage cutter. In either situation a gain in physical size by either set of cutters must be accomplished by a sacrifice in size of the other.

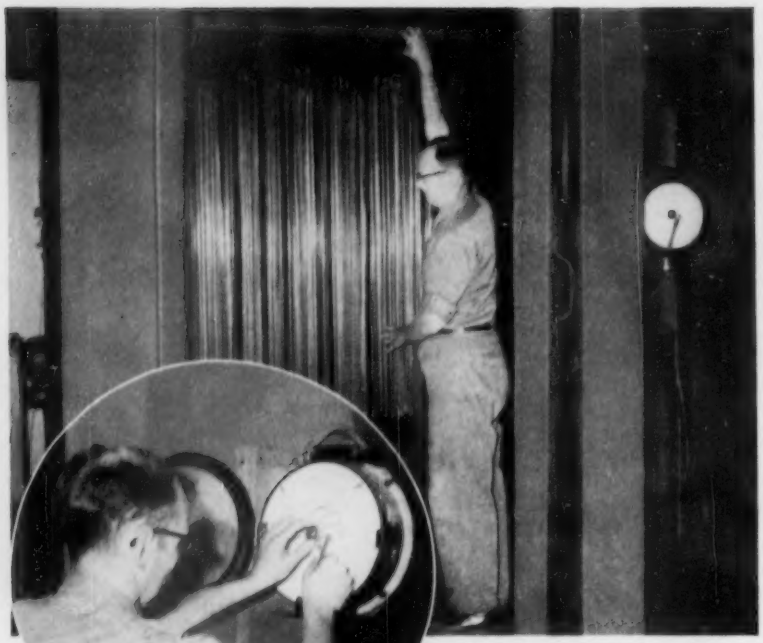
Increases in both the gage-cutter bearing structure and physical size of the crosscutters would be possible by an increase in gage-cutter diameter. The undesirable effect resulting from an increase in gage-tip diameter, however, generally offsets any improvement derived from the change. This effect, as illustrated by Fig. 13, is similar to that previously shown for the cone bit. Here again the gage-tip location A on the enlarged cutter must be moved inwardly in order to maintain proper hole diameter. In so doing, the amount of formation B removed by reaming action would again be excessive.



EFFECT of increase in gage-cutter thickness on crosscutter diameter. Fig. 12.



EFFECT of oversize gage-tip diameter on amount of reaming required by gage surface. Fig. 13.



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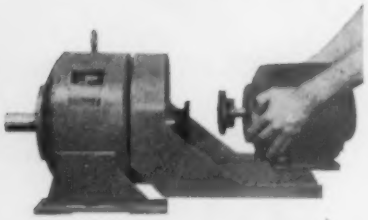

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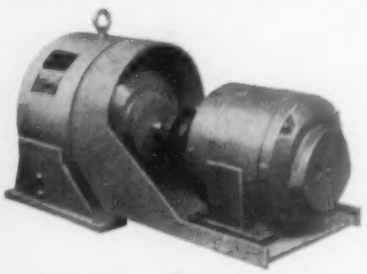

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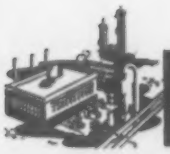


JOB IMPROVEMENT FOR THE PROCESS FOREMAN—65

Distillation Heat Supply Requires Attention

IN a distillation process, sufficient heat must be supplied to vaporize the lighter materials in the oil charged to the tower. The quantity of heat required will, of course, be different for various operations, but at least enough heat must be supplied to vaporize the total overhead from the tower (product plus reflux). Normally, heat is supplied in a distillation process in one or both of the following ways:

1. Feed preheat—pipestill heater, steam preheater, bottoms-feed exchanger, hot flow from bottom of previous tower.
2. Partial vaporization of tower bottoms product—reboiler.

Most of the towers in the refinery associated with separation of light oils employ a combination of feed preheat and reboiling as a heat source. Most of the towers in lube or crude-oil distillation service must rely entirely on feed preheat as the heat source. Use of reboilers in lube or crude-distillation service is limited because the bottoms temperatures necessary for separation are extremely high (above 350° F.). The temperature of the heating medium in the reboiler must be correspondingly high. The temperature of high-pressure steam (340°-450° F.) is usually inadequate in such services.

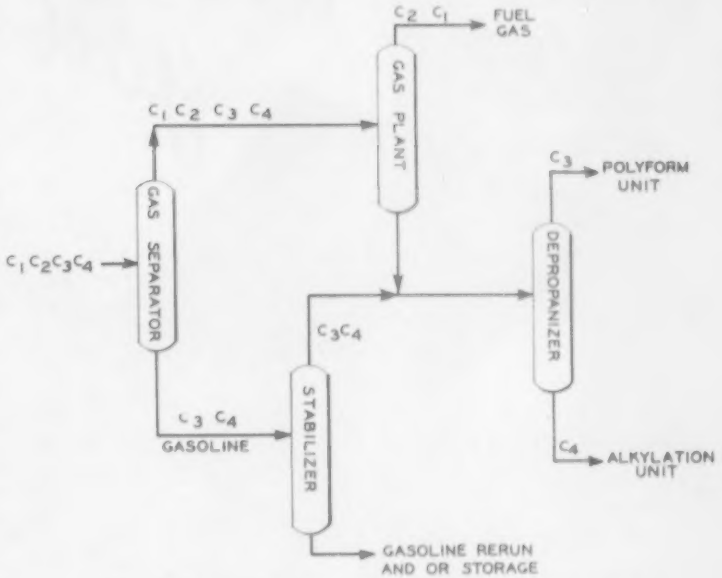
Chemical companies employ high-boiling-point materials, such as Dowtherm for high-temperature reboilers. However, high-boiling materials are not generally used in the refinery.

In subsequent discussion of reboiler type of towers, the emphasis will be placed on such light-oil operation as depropanizing, debutanizing, or stabilizing and gasoline rerun.

Another basic difference between lube or crude oil and light-oil distillation should be emphasized. The separation of light-oil products is much more difficult than heavy-oil separation since essentially pure hydrocarbons are involved.

In heavy-oil distillation, the separation involves a mixture of compounds and no distinct separation of pure hydrocarbons. Taller towers with more trays must, therefore, be used in distillation of light-oil products. For example, debutanizers and depropanizers are designed with 25 to 40 trays while separation of kerosine and light gas oil requires only four to six trays.

For this reason, light-oil towers are designed for only one separation, i.e., side-draw towers are not used in light-oil fractionation.



FLOW DIAGRAM shows how towers are linked together. Fig. 8.

Light-oil distillation . . . The light materials produced on the cracking units consist of hydrogen, air, methane, ethylene, ethane, propylene, propane, isobutane, butylene, normal butane, and gasoline. The materials can be grouped according to ultimate use as follows:

Hydrocarbon group	Primary disposition
Ethane and lighter	Fuel gas
Propanes	Polyform unit
Butanes	Alkylation unit
Gasoline	Gasoline blending

These light hydrocarbons are recovered and segregated through use of reboiler type of distillation towers, such as depropanizers, debutanizers, etc. The recovery operations are discussed later in detail.

It is first necessary to visualize how the various towers are linked together to accomplish the final dispositions shown. This can best be seen by examination of a simplified flow diagram. Hydrocarbons from the cracking units are fed into a gas separator where a sloppy separation occurs.

The liquid at this point contains mostly propanes, butanes, and gasoline, while the gas contains mostly methane, propanes, and butanes. The liquid product is fed to a debutanizer where propanes and butanes are removed from gasoline. The gas portion goes to a gas plant where propanes and butanes are recovered and the ethane and lighter goes to fuel gas. All the propanes and butanes are mixed and charged to a depropanizer. The overhead products from this tower contains relatively pure propanes while the bottoms product is largely BB (butane-butylene mixture). This flow diagram is shown in Fig. 8.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

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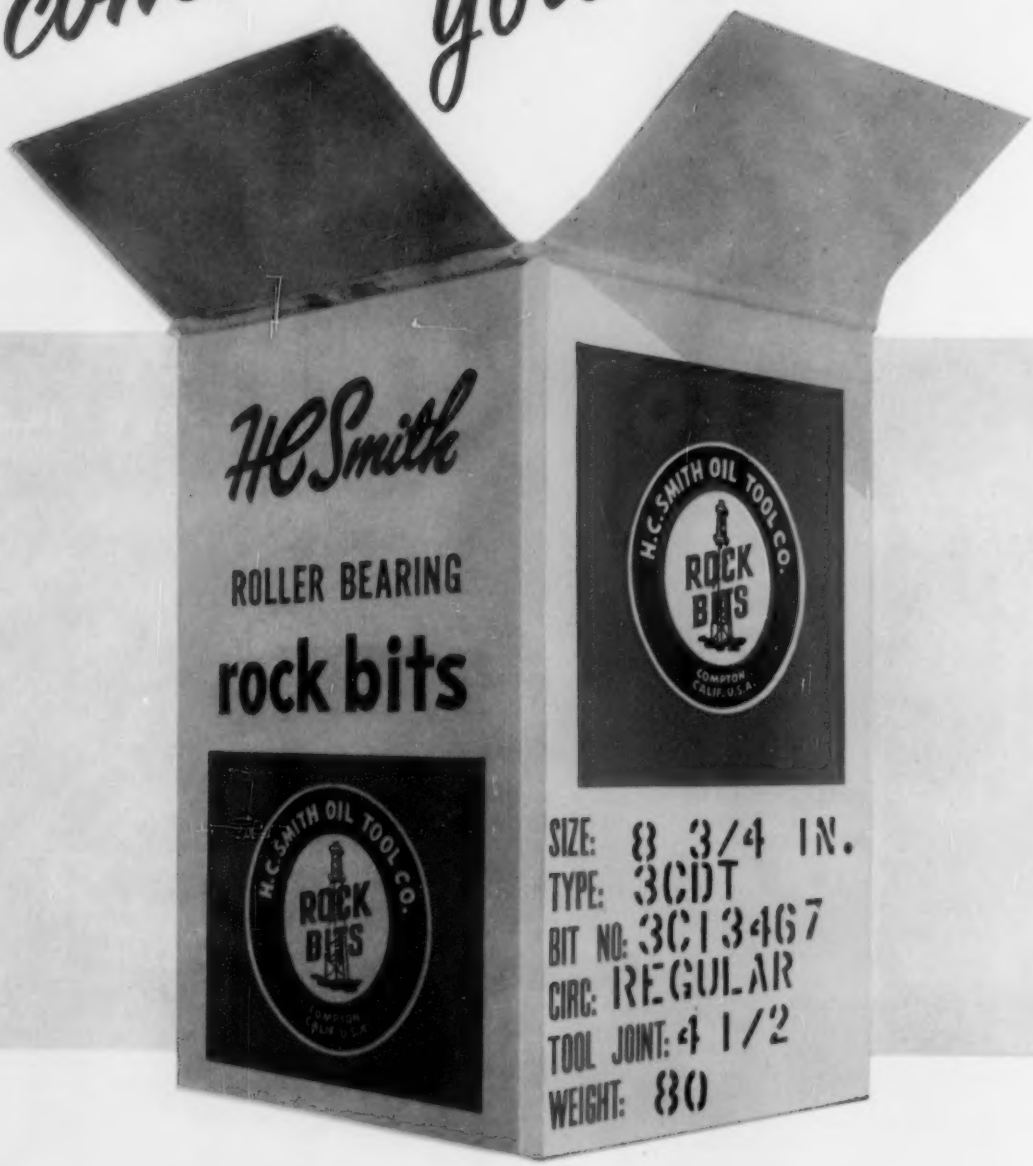

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Ocean Drilling & Exploration Co. has the contract on another well Shell Oil Co. will drill at its East Cameron Block 17 field, in the Gulf of Mexico, 3 miles off the coast of southeastern Cameron Parish, Louisiana. It will be a 13,000-ft. job, designated as 2 State Lease 2,545.

Bay City Drilling Co. has taken a 4,200-ft. contract for a wildcat test to be drilled northwest of Ottina, in the northwest corner of Gonzales County, just south of the intersection of Guadalupe and Caldwell county line. Operating company is North Central Oil Corp., of Houston. Location is for 1 Webb, in the Elijah Tate Survey, on the west bank of San Marcos River.

Crow Drilling & Producing Co., Shreveport, has a new 7,300-ft. contract job in the Bethany-Longstreet area, in DeSoto Parish, northwestern Louisiana. It is a Travis Peak test for R. A. Stacey, of Shreveport. Location, at 1 Stevenson Unit, in 16-13n-14w, is on the southeast flank of the field.

Survey Drilling Co., Dallas, has a rig working on a wildcat location in northeastern Escambia County, in the northwestern corner of Florida's Panhandle, and just south of the Alabama line. It is a contract job for T. E. McMillan, of Brewton, Ala., and A. R. Temple of Biloxi, Miss. The test is carried as 1 Daniell, with spot location in 1-5n-32w, about 3 miles south of Canoe, Ala.

Morrison Drilling Co., Inc., Casper, is contractor on Atlantic Refining Co.'s new Tensleep wildcat in the Kaycee area, 15 miles northwest of West Sussex field, in Johnson County, northeastern Wyoming. Location is on government land, in 3-43n-82w.

Dorris Ballew, Inc., Natchez, Miss., has a rig on a wildcat location 2 miles northeast of Sicily Island field, in Catahoula Parish, East-Central Louisiana, where it is working on a 6,000-ft. Wilcox test for R. A. Campbell, of Vidalia, La., just across the Mississippi River from Natchez.

Zach Brooks Drilling Co., El Dorado, Ark., is drilling for Shell Oil Co. at a wildcat location northeast of Wisner field, in Franklin Parish, North Louisiana. It is Shell's 1 Sproles, in 34-12n-7e, a 7,500-ft. Tuscaloosa test.

Woolf & Magee, Tyler, Tex., are drilling for Clay Oil & Gas Corp. at a wildcat location a mile north of Jeanette field, in Adams County, southwestern Mississippi. It is a 6,400-ft. Wilcox test at 1 Baker, in 19-6n-1w.

Coastal Drilling Co., Los Angeles, is getting ready to drill a deep wildcat test for Humble Oil & Refining Co. at Rumsey Hill, 12 miles west of Dun-

ON THE FLOOR of a deep-drilling, barge-mounted rig Cracey-Heliums Corp., of Houston, has been operating under contract in the coastal marsh region of Louisiana. Standing, left to right: Marion Cook, tool pusher; E. C. Rogers, driller; A. J. Nelton, derrickman; and Renis Dooley, engineman. Front row, same order: Melvin Toups, Delvin Foret, and Henry Foret, floormen. Picture was taken on a wildcat test recently drilled for Union Oil Co. of California southwest of Lake Pelto dome, on the coast of Terrebonne Parish.

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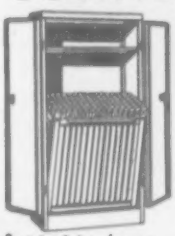

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nigan, in Yolo County, northern California. Humble is planning on a 12,000-ft. test, one of the depest tests ever drilled in that part of the state. It is scheduled as 1 Tippets, with spot in 15-12n-3w. A 10-mile access road had to be built to the location. Rig is coming from Coastal's Bakersfield yard.

Win Hawkins Drilling Co., Houston, has a new swamp-located operation coming up. It will be a deep test for Oil Reserves Corp., of Houston, at a wildcat location 2 miles northwest of Whitecastle field, in Iberville Parish, Coastal Louisiana. Location is for 1 Baist Cooperage, in 4-11s-12e. It will be the operator's first test.

Steen Drilling Co., Houston, will drill for Continental Oil Co. at a wildcat location 2½ miles west of Indian Village field, in northwestern Jefferson Davis Parish, southwestern Louisiana. It will be a 9,500-ft. job with location at 1 Quatre, in 26-7s-7w.

Deepwater Exploration Co. has contracted for two more tests Anderson-Prichard Oil Corp., of Oklahoma City, is planning for its lease block in Blocks 38 and 39, East Cameron area, in the Gulf of Mexico, 8 miles off the coast of Cameron Parish, Louisiana. Both tests are projected to 14,000 ft. The new contracts are for 2-A State Lease 1184 (OCS 0304), in Block 38, and 3-A State Lease 1186 (OCS 0306), in Block 39. Deepwater also has the contract for Anderson-Prichard's initial test, 1-A State Lease 1185 (OCS 0305), in Block 39, also set up for 14,000 ft.

Pearl Drilling Co., Alice, Tex., has a new operation in the Peters area, 18 miles south of Freer, in the west-central part of Duval County, Southwest Texas. It is a contract job for J. P. Bristow, of Houston, at 7-A Peters, a 3,000-ft. semiwildcat.

Tucker Drilling Co., San Angelo, Tex., has a 6,000-ft. test working for L. E. Scherck and others in Coke County, West-Central Texas. It is a wildcat location, 1 Sayner, in WCRR Survey 114, about 3 miles south of Tennyson.

Offshore Drilling Co. has taken a contract with the estate of William G. Helis, of New Orleans, for a 10,500-ft. wildcat test in the southeast tip of West Baton Rouge Parish, South Louisiana. Location, at 1 Australia Planting, is about 10 miles down the Mississippi River from Baton Rouge. It is 3½ miles north of Sunshine field, in Iberville Parish, and about 4 miles west of Burtville field, in East Baton Rouge Parish.

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Koenig cabs and King Winches for Willys vehicles available through all Willys Motors, Inc., dealers and distributors in U.S.A. . . . and Willys-Overland Export Corp. distributors in other countries.

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Get More Hole For Your Wire Rope Dollar with

J&L SpringKore

Rotary Drilling Lines

SpringKore's tightly coiled, high quality steel spring center was developed by J&L to give rotary drillers a wire rope with unusually high resistance to crushing action *plus* extreme flexibility.

Check these features of J&L SpringKore Rotary Drilling Lines and see why you get longer service life on your rotary rigs at lower drilling line costs.

LONG-TERM FLEXIBILITY
SpringKore's highly flexible center and wide distribution of internal pressures maintains original rope flexibility under long periods of heavy-duty service.

RESISTS CRUSHING ACTION
Coiled steel spring center has great resistance to crushing . . . snaps rope back to its original shape and diameter.

COMPLETE LUBRICATION
SpringKore's hollow center acts as a lubricant reservoir . . . reduces corrosion and friction wear by assuring lubrication of innermost parts of rope.

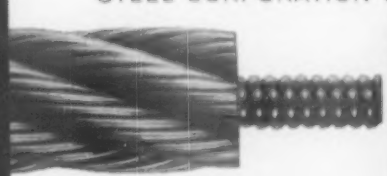
MORE SUPPORTING CONTACT POINTS
The coiled shape of the spring center gives the strands of the rope more supporting points . . . reduces friction by spreading pressure evenly over many contact points.

UNIFORM DIAMETER
The firm internal support provided by the spring center maintains uniform rope diameter . . . reduces wear caused by outer strands rubbing against each other.

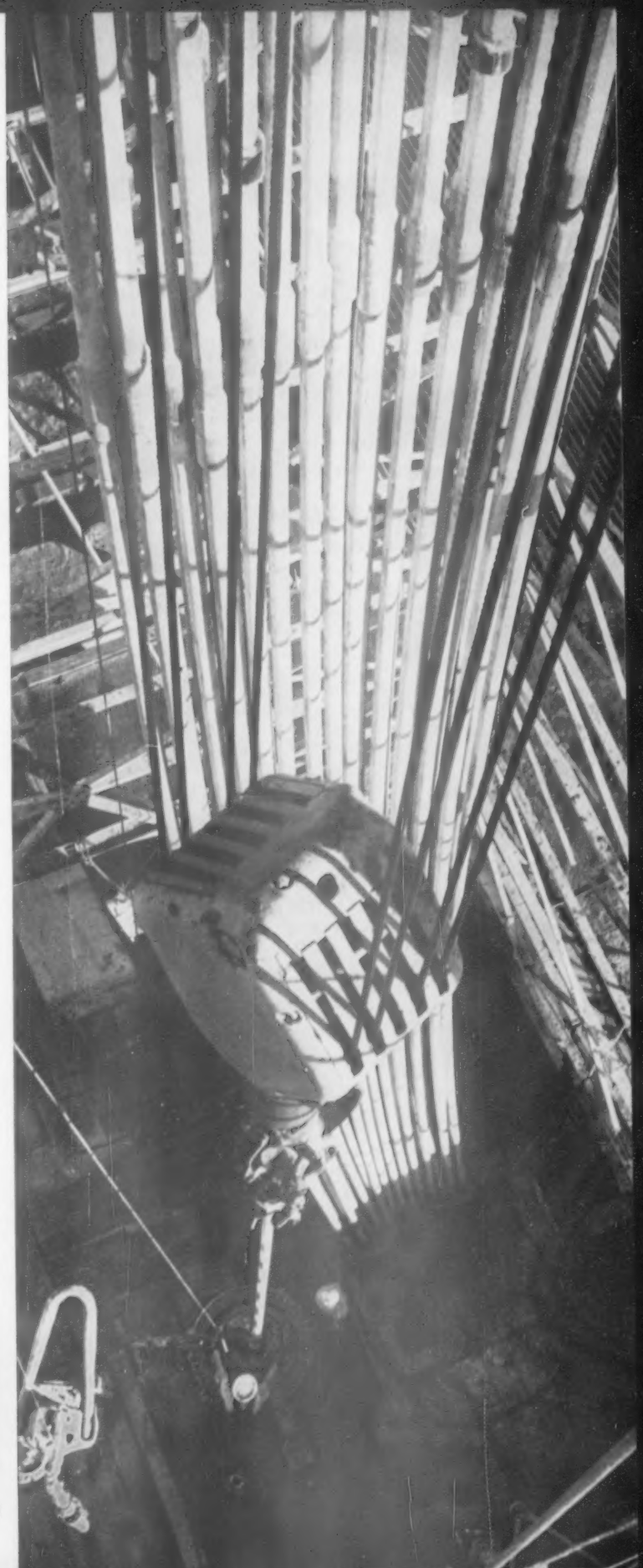
LESS INSIDE STRAND WEAR
The spring center flexes under crushing instead of scoring strands . . . reduces wear on inside wires.

Put these SpringKore advantages to work on your rotary drilling rigs. Specify J&L SpringKore Rotary Drilling Lines. Available in standard sizes and construction.

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH



J&L STEEL



Radioisotopes in Refining—2

Radioisotopes Solve Five Refining Problems

- Measuring mixing efficiency of surge tank.
- Segregating tar bottoms from crude stills.
- Measuring tar entrained in distillate streams.
- Determining how much toluene in product was derived from methylcyclohexane in feed.
- Measuring deposits laid down in engine to test fuel-additive combinations.

by
B. A. Fries, D. E. Hull, and S. B. Jones

CALIFORNIA RESEARCH CORP. uses isotopes to solve a number of refining problems. Here are five case histories showing how these versatile tools may be used in day-to-day operation. These examples are taken from an oral presentation before the World Petroleum Congress, Rome, June 1955. This information has been released to The Oil and Gas Journal by special arrangement with the authors.

1. Blending Study

The situation . . . A 50,000-gal. surge tank is used to mix thermal cracking-plant feed stock from two different sources. Surge-tank contents are mixed by a pump in a side loop, at the rate of 100,000 bbl. per day. When switching from one stock to another, adjustments to the cracking-plant operating conditions are made easier if the feed characteristics vary gradually rather than abruptly.

Authors are with California Research Corp., Richmond, Calif.

. . . The problem: Measure the mixing efficiency of the surge tank.

. . . The solution: Inject a radiotracer on the input line and measure the activity with Geiger counters strapped to the outgoing line. This is a comparatively simple procedure. A proper radioactive isotope can be selected from a fairly wide range. It must be miscible in both feeds. It must have a sufficiently long half life to avoid complications due to decay. It should emit gamma rays of sufficient energy to penetrate the pipe walls.

In this case, 46 millicuries of radioactive zirconium 95 in an oil-soluble complex was bled into the intake line in 50 bbl. of feed. The first activity on the outgoing line was noted 12 minutes after the tracer entered the tank. Thereafter, the activity fluctuated as shown in the chart.

For ideal mixing the theoretical (dotted) curve would show a sharp initial rise and then diminish steadily as the labeled stock was displaced from the tank.

Extensive mixing did occur in the surge tank, as the labeled material was diluted at least 500 times in the effluent line. But the wide fluctuations in observed activity showed that mixing was not complete. Up to the end of the 5-hour test, large batches containing no tracer were found interspersed with labeled batches. This simple test gave an accurate picture of the efficiency of mixing in the surge tank.

2. Tar Segregation From Crude Stills

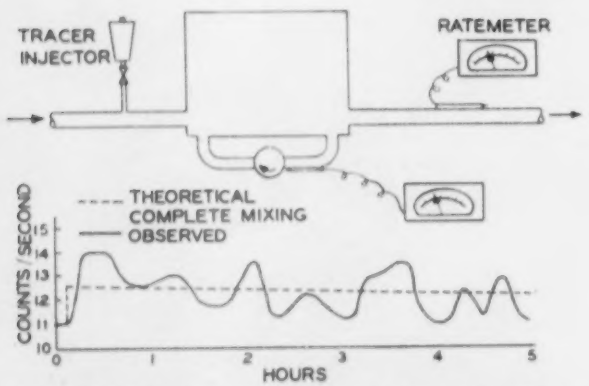
The situation . . . A battery of four crude stills in series is equipped with baffles to minimize mixing of various crude charges.

. . . The problem: It is desired to segregate the tar bottoms from two different crudes fed alternately to the battery. Is it possible to make a sharp break?

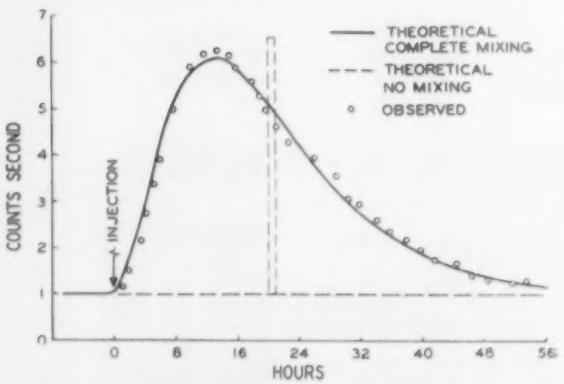
. . . The solution: When switching crudes to the battery, an injection of cobalt 60 naphthenate was made at the interface in the crude charging line. The tar line leaving the battery was metered for several days with a Geiger counter.

If the second crude had completely displaced the first crude through the

REFINING



1—BLENDING STUDY with radioisotopes shows mixing efficiency.



2—TAR-SEGREGATION STUDY on battery of four crude stills.

system with little mixing, the tracer would have shown first appearance in the tar effluent in a sharp peak 21 hours after injection. Actual observations proved the labeled interface began to show up only 2 hours after injection. It was spread out into a broad, diffuse wave with a peak at 14 hours and a tail persisting into the third day.

The solid line indicates the activity to be expected if mixing were complete in each still. The observed readings showed close agreement with this curve, proving that mixing in the stills was close to ideal. Therefore, it was proved completely impractical to effect the desired sharp break in segregating tar from the two crudes.

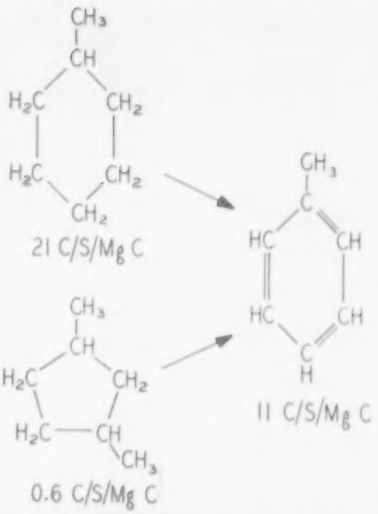
3. Tar Entrainment Study

The situation . . . An evaporator in a thermal cracking unit was admitting some tar to overhead streams by entrainment.

. . . The problem: A quantitative measurement of how much tar is being entrained into distillate streams was needed. This type of test is important in distillation units because tar cannot be tolerated in refined distillate products. It must be excluded from intermediate distillate streams fed to heaters, to retard the formation of coke in furnace tubes. Tar also contains metallic contaminants and a small amount in heavy gas oil fed to catalytic cracking units can poison the catalyst.

This problem entails a study of separation, which is more difficult than blending or mixing studies. In the latter, any isotope compatible with both blend stocks will suffice. In most separation studies the tracer must show similar physical and chemical properties to one of the phases. Often, this similarity must be so close that isotopic compounds, or identical compounds containing radioactive elements, must be used.

Entrainment, however, is a result of incomplete separation. The entrained particles of crude tars remain in the liquid phase as they are swept upward in evaporators and distillation columns. Hence, a phase tracer, or a compound which remains in the liquid phase under the conditions imposed, is satisfactory for this type of separation study.



4—PATH OF CHEMICAL REACTION was determined using radioisotopes.

. . . The solution: Cobalt 60 naphthenate tracer was injected into the feed to the evaporator in a short surge. A Geiger counter attached to the line carrying the bottoms fraction to the tar tanks recorded the activity of the bulk of the radiocobalt compound, which did not vaporize in the unit. Another counter attached to the overhead stream recorded the cobalt naphthenate which was entrained upward in the evaporator in the form of liquid droplets.

By integrating the counts on both streams and making corrections for the different flow rates in the two lines, a quantitative measure was obtained of the percentage of tracer and hence of tar, going into the distillate. Under varying operating conditions, values ranging from zero up to a few per cent were obtained. This test gave operators a direct measurement of tar entrained and permitted them to evaluate the entrainment of varying operating conditions.

4. Chemical Reaction Studies

The situation . . . In a pilot-plant-scale catalytic reforming unit, feed stock comprising principally methylcyclohexane, demethylcyclopentanes, and n-heptane together with small amounts of other naphthenes and paraffins, is converted to toluene and xylenes plus smaller amounts of coke, light paraffin gases, and other paraffins, aromatics, and naphthenes. The unit employs a molybdena-alumina catalyst.

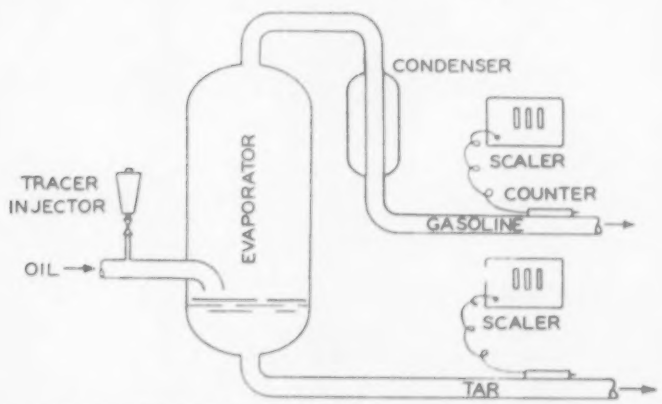
. . . The problem: The object of the experiment was to determine how much of the toluene in the product was derived directly from the methylcyclohexane in the feed. This was a case requiring an isotopic tracer, or an identical compound to the one under study with a radioactive isotope substituted for the stable one.

. . . The solution: Methylcyclohexane, labeled in the methyl group with carbon 14 was added to the feed to the unit. The reaction products were then separated and the distribution of the carbon 14 isotopes was determined by measuring the relative radioactive of the separate fractions.

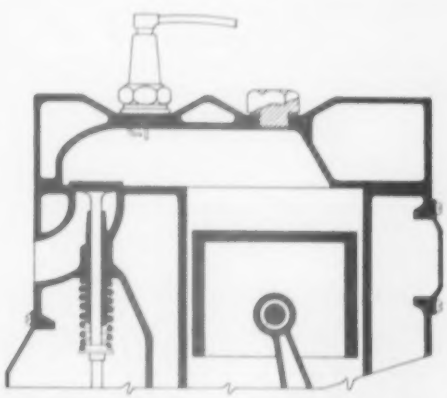
The test showed that only half of the toluene was derived from methylcyclohexane. The remainder must have come from dimethylcyclopentanes because the catalyst was not active in converting heptane to toluene.

Carbon 14 was found in benzene and in the benzene ring of the toluene which indicated that some isomerization occurred. The recovered dimethylcyclohexane has the same specific activity as at the start.

These results were interpreted to mean that little isomerization of methylcyclohexane to dimethylcyclopentanes



3—TAR-ENTRAINMENT STUDY defined amount of tar going overhead in an evaporator.



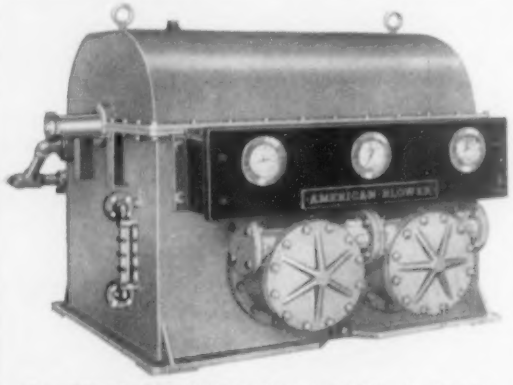
5—RADIOACTIVE PLUG enables study of deposit formation in engines.

American Blower Gýrol Fluid Drive lets you adjust pump flow rates—*as needed*

Accurate control of the flow of gases and fluids is the key to the successful operation of a catalytic reforming plant. American Blower Gýrol Fluid Drive gives you simplified speed control of compressor and pump flow rates, regardless of size or horsepower. The secret? The vortex of oil in every Gýrol Fluid Drive that allows smooth, shockless speed and torque adjustments between the motor and the load.

The combination of a Gýrol Fluid Drive and a general-purpose induction motor provides stepless, adjustable speed for flow control. The Gýrol offers the same flexibility of operation as the steam turbine, and like turbines, adjustable flow can be obtained without throttling valves.

Gýrol Fluid Drives provide a better means of power transmission and a simple solution to problems of controlling compressor or pump flow rates, even with variations in density or temperature. Call your nearest American Blower Office for further information.



Type VS Gýrol Fluid Drive. Class 4 and Class 6 (shown). Adjustable-speed drive for compressors, pumps and other high-speed applications. 100 to 12,000 hp, to 3600 rpm.

AMERICAN BLOWER

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took place under the reaction conditions. If methylcyclohexane was an intermediate in the production of toluene from dimethylcyclopentanes, the methylcyclohexane so formed did not exist in the free state but rather the absorbed intermediate was rapidly dehydrogenated to toluene on the catalyst.

5. Engine Deposit Measurements

The situation . . . Various fuels and fuel additives are evaluated in actual engine tests to determine their deposit-forming characteristics.

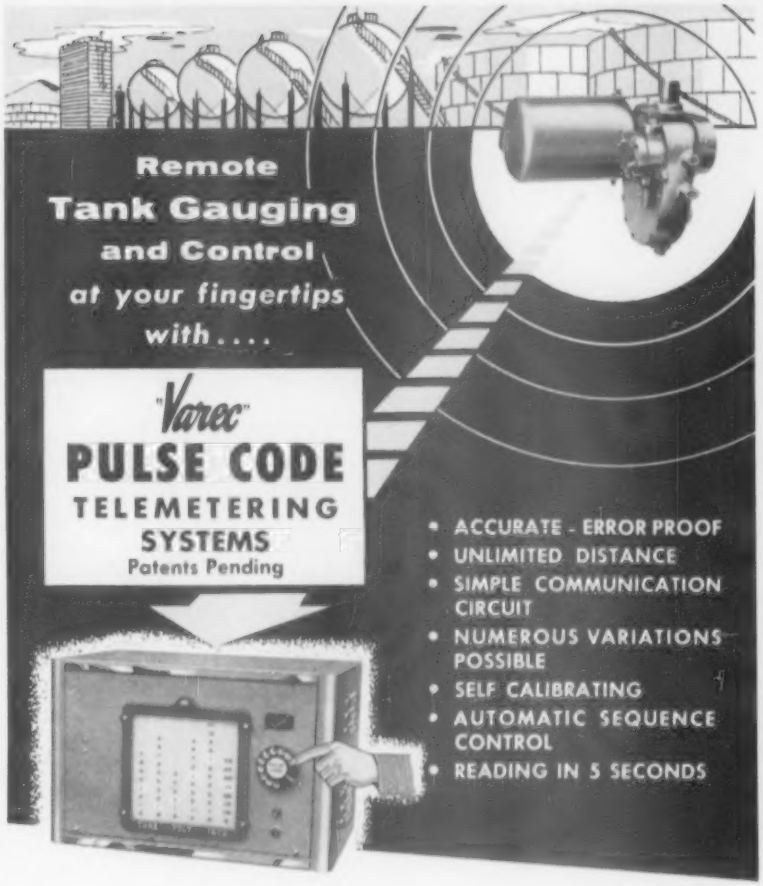
. . . The problem: A rapid accurate method for measuring very thin deposits laid down in engines is needed to test many fuel-additive combinations. For better duplication of results, the engine should not be torn down between tests.

. . . The solution: This type of test calls for a technique for measuring the thickness of deposits by comparing the count rate of a radioactive surface before and after deposits were laid down on it. Using soft beta-ray emitters such as sulfur 35 and nickel 63, deposits of only a few hundredths milligrams per square centimeter can be measured in specific areas of carburetors and intake manifolds. In the combustion chamber, deposits ranging from 1.05 to 20 mg. per sq. cm. thickness can be measured using sulfur 35 and cobalt 60 beta rays.

In the combustion-chamber deposit tests, the surface of a plug was made radioactive by incorporation or deposition of a suitable radioisotope. After careful measurement of the count rate, the plug was inserted into the portion of the engine under examination as shown in the figure. Following only a few minutes of engine operation, the plug was removed and the thickness of the deposit laid down on its surface was determined by a second count-rate measurement. The difference in radioactivity represented the amount of beta-ray absorption by the deposit, hence its thickness.

This technique permits the testing of many fuels and additives over a short period, with only brief engine-shutdown intervals necessary to remove, scan, and replace the plug. This method was used in the company's program leading to a new detergent gasoline additive. The testing of a like number of experimental fuels and additives, by long runs followed by dismantling the engine and scraping and weighing deposits, would have been prohibitive.

The same technique could be applied to the measurement of scale formation in boiler tubes, corrosion, wear plating, and other uses. It is particularly advantageous for the measurement of deposits in inaccessible locations.



Pioneers in the remote gauging field, "Varec" has researched the various possible types of remote gauging, and developed a system that offers an unusual combination of advantages for the user. "Varec" PULSE CODE uses a distinct code combination of dots and dashes for each signal to insure accurate reading; the possibility of error resulting from a miscount of pulses, as in a "pulse-count" system is avoided. If the communications channel is capable of carrying any other type of information accurately, it will handle Pulse Code signals without error, or else give no signal. Reliable readings to the nearest 1/8 inch. The system can be operated over all types of communication channels, including micro-wave.

You dial for desired information, then through the use of interlock circuits, the instrument takes over, **to give you a fast reading in 5 seconds.**

Power failure or line trouble will not cause loss of calibration. Normal operation will return on restoration of power. The equipment is rugged and reliable. Vacuum tubes are not used in the measuring circuit.

Great flexibility is assured by the "building-block" design. Special installations can be constructed with standard units – unlimited variations possible. Can provide, with appropriate equipment, a means for remote control of pumps, valves, high-low alarms and similar operating equipment.

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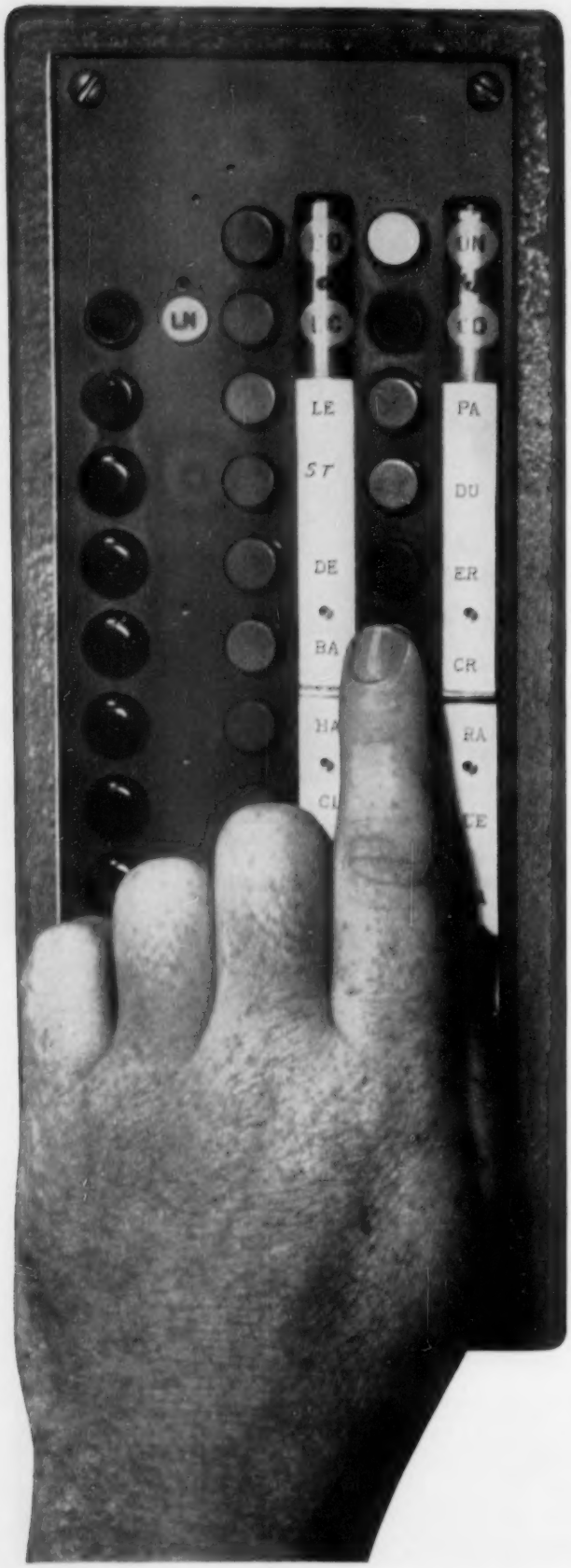

Push-button selector speeds coded data in Gulf Interstate's telemetering system

You are looking at a special push-button private line teletypewriter device developed by the Bell System and used by Gulf Interstate Gas Co.

The company uses the teletypewriter as a recorder in its digital telemetering system, which provides automatic transmission of operating data. Such data includes engine speeds as well as suction and discharge pressures at five remote compressor stations.

The dispatcher in the company's Houston headquarters simply pushes the proper buttons. The selected distant station is instantly on the circuit. Coded telemetered data is then received directly on the teletypewriter in the form of an accurate, easily read record.

This unique selector unit is another example of how equipment developed by the Bell System meets communication needs.

The Bell System welcomes the opportunity to work with you in a study of your special communication requirements. There's no obligation.

Bell Telephone System

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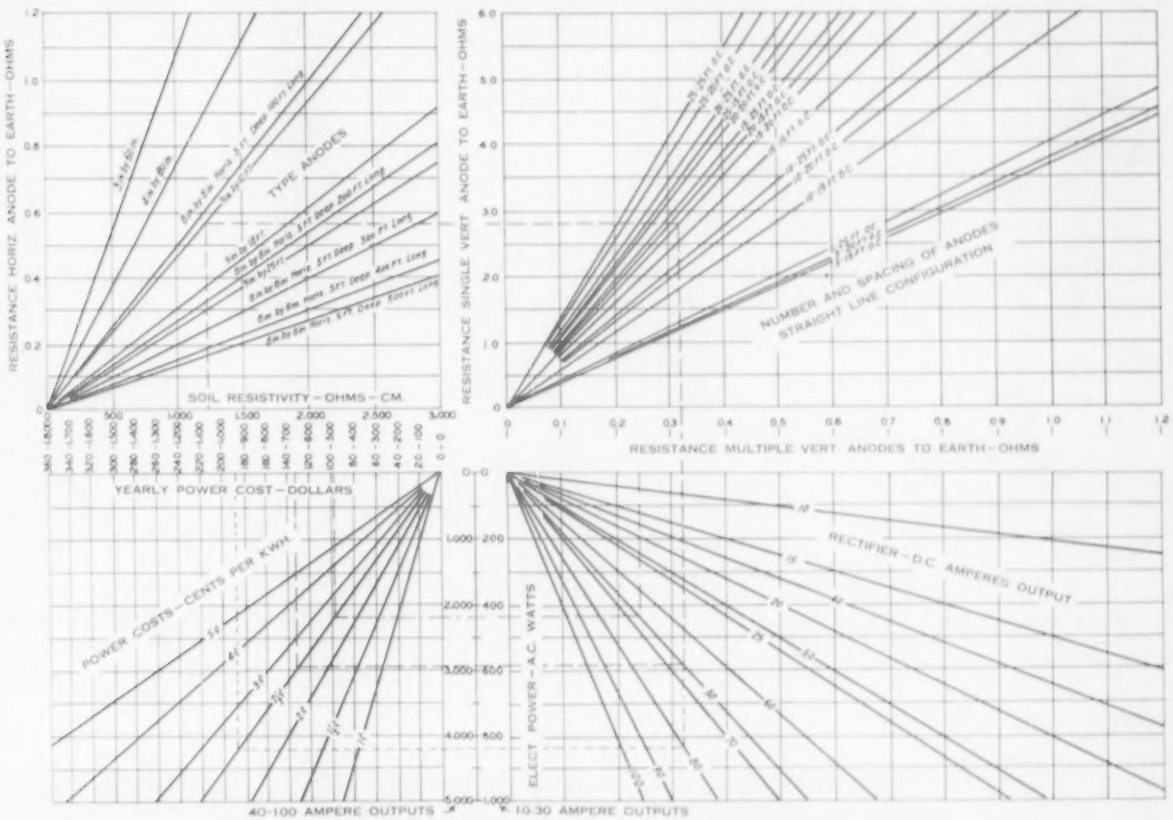
CHANNELS FOR: DATA TRANSMISSION • TELEMETERING
REMOTE CONTROL • TELEPHOTOGRAPH • CLOSED CIRCUIT TV


RESISTANCE HORIZ. ANODE TO EARTH – OHMS
SOIL RESISTIVITY – OHMS – CM.
TYPE ANODES
RESISTANCE SINGLE VERT. ANODE TO EARTH – OHMS
NUMBER AND SPACING OF ANODES
STRAIGHT LINE CONFIGURATION
RESISTANCE MULTIPLE VERT. ANODES TO EARTH – OHMS
YEARLY POWER COST – DOLLARS
POWER COSTS – CENTS PER K.W.H.
ELECT. POWER – A.C. WATTS
RECTIFIER – D.C. AMPERES OUTPUT
40-100 AMPERE OUTPUTS
10-30 AMPERE OUTPUTS

THIS CHART will speed up calculations in planning installation of cathodic protection combinations. Fig. 1.

New chart for calculating power costs

. . . use it for cathodic-protection data

IN planning any given cathodic protection installation a number of combinations of anodes and spacings should be considered. The chart (Fig. 1) speeds calculations of annual costs using different combinations.

For example, suppose a rectifier installation is planned in an area where soil resistivity is 1,225 ohm-cm. Current requirement tests on the line to be protected show that 30 amp. of d.c. current will be needed. It is up to the planning engineer to determine the most economical ground-bed configuration which will permit that current flow.

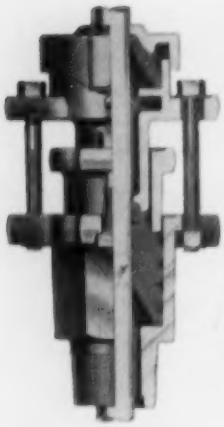
In the upper left part of the chart, start with 1,225 ohm-cm. and proceed to the particular-size anode desired originally. In this case, assume use of fifteen 8⅝-in. steel-pipe stalks on 20-ft. centers. Proceed horizontally across the chart to the 15-20-ft. curve, then vertically down to the 30-amp. curve. Note that the resistance of one anode would be about 2.8 ohms while the resistance of 15 would be 0.32 ohms.

From the intersection with the 30-amp. curve proceed left to the curve showing power cost per kilowatt-hour. A vertical line from this intersection to the left abscissa gives the yearly cost for power for that particular ground-bed configuration and current output.

Of course the chart cannot take into account the material cost and this must be balanced against annual costs in choosing the proper ground bed. In the case above, a horizontal ground bed 300 ft. long would actually give a lower annual power bill. But ditching and installing the horizontal anode might well be much more expensive. Note that the cost for vertical anodes per year is about $130 while that for horizontal would be about $98.

The dotted lines in the chart show how to use the curves for larger current outputs. Using the same type of anode and with a current requirement of 80 amp. instead of 30, the yearly power costs would be about $930.

This chart was developed by John Searcy, president of Corrosion Services, Inc., Tulsa, while he was with Service Pipe Line Co. Most of the curves are a result of empirical data, i.e., plotted from measurements made on many ground beds where soil resistivity was known. Resistances for some ground-bed configurations were calculated from formulas of H. B. Dwight, originally published in the June 1936 issue of Gas magazine.



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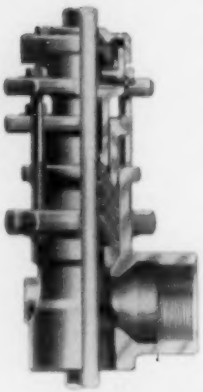
Hercules Stuffing Boxes

CAN END YOUR PUMPING WORRIES*

"REGULAR TYPE" DUPLEX POLISHED ROD STUFFING BOX

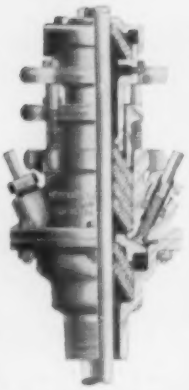
The old reliable, tried and proved on thousands of wells from coast to coast and in foreign fields.

HERCULES OIL RESERVOIR UPPER GLAND



"TEE BASE TYPE" DUPLEX POLISHED ROD STUFFING BOX

A combination Stuffing Box and Pumping Tee. Makes a short connection. Bolt lugs are placed low to eliminate fouling of elevator links. No bell nipple needed as top of body will support elevator. Full opening — unnecessary to remove body when pulling or running rods.



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A Double Packed Stuffing Box for use on high pressure wells and those that flow intermittently. Especially desirable for wells located near buildings, fire hazards of growing crops. Two compression bolts, in bottom sections, are tightened on Cone Rings to pack-off while replacing packing in upper section.

All HERCULES Stuffing Boxes are made of high grade malleable iron which prevents shattering if rods drop. They are tested to 3,000 pounds psi pressure and all use the famous HERCULES Split Cone Packing Rings.

* All HERCULES Stuffing Boxes may be equipped with Oil Reservoir Upper Glands on "problem" wells which pump-off and burn the packing. The polished rod moves through the oil in the reservoir which lubricates and cools it.

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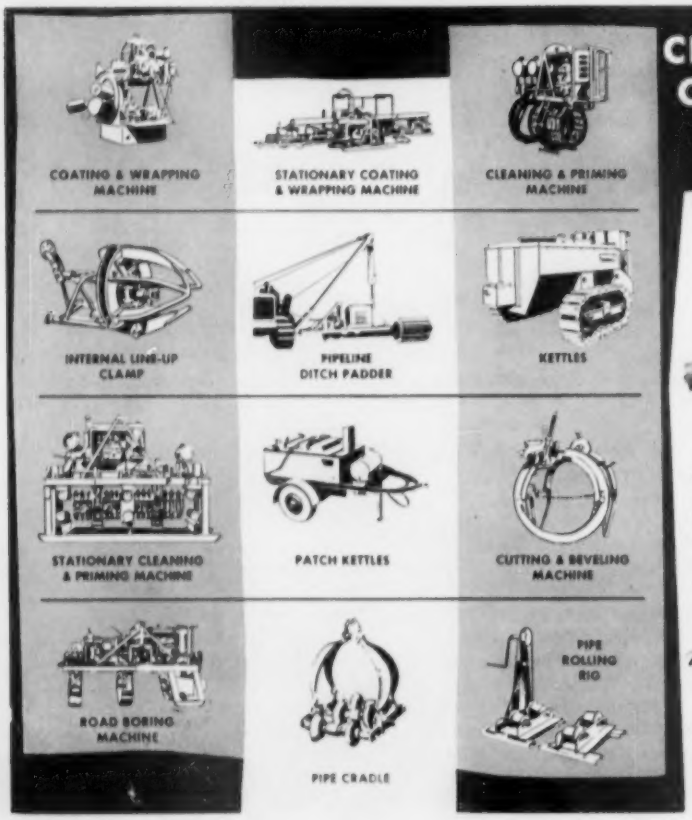
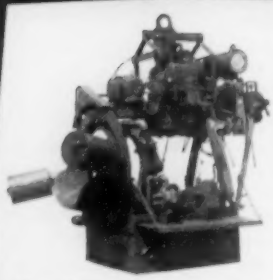


CROSE SPRAY-RING TYPE COATING & WRAPPING MACHINE



The spray-ring applicator makes this Crose machine the finest on the line . . . and more contractors use them!

The Crose machine assures uniform coating . . . precision wrapping . . . it coats Bends or "Egged" Pipe.

Available in sizes that handle pipe 2" to 36".

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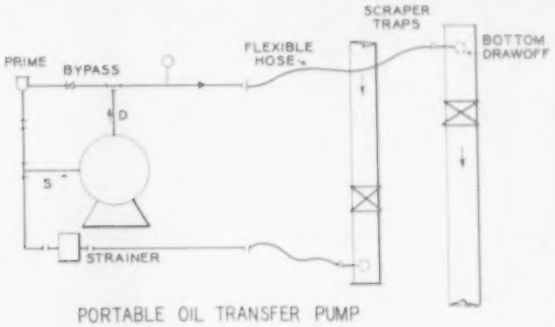
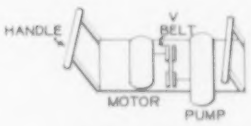


PORTABLE PUMP used in cleaning crude-oil pipelines.

PORTABLE OIL TRANSFER PUMP

Oil-transfer pump used in pigging



SKID MOUNTED

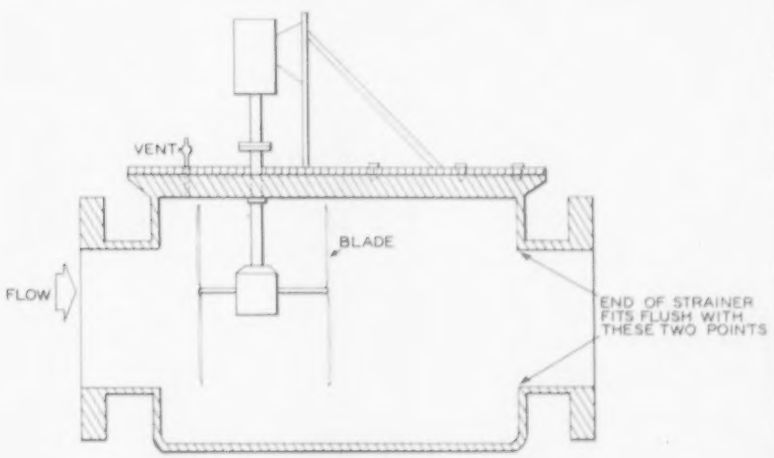
A PORTABLE oil-transfer pump is handy when running scrapers in crude-oil pipelines.

One pump system consists of the basic prime mover connected by V-belt to the pump, a strainer, prime, gage and bypass. All of this is conveniently skid-mounted on a rack which is equipped with handles for convenience.

Flexible hoses are coupling connected to the lines on the portable unit and are tied in to bottom drawoffs on the scraper traps. The pump takes suction from the incoming scraper trap and discharges into the outgoing scraper trap. When a pig arrives, the oil is transferred out of the incoming trap prior to removing the pig.

Before this method was used, oil remaining in a trap would be drained into a sump when the pig was removed from the trap. The oil would then have to be disposed. This is eliminated entirely with the portable transfer pump.

Method suggested by William P. McConnell, Jr., foreman, Fort McKavett station. Courtesy Humble Pipe Line Co.



PARAFFIN CUTTER is motor driven.

Paraffin cutter saves time

PANHANDLE crude poses a paraffin problem when being pumped. One solution is the use of a motor-driven paraffin cutter on the strainers.

The cutter consists of dual blades mounted within the strainer and driven off a common gear box which is powered by a motor.

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Better PIPE TOOLS

CHAIN TONGS

"Reversible," "Standard" and "Ideal" types in all sizes. Jaws are drop forged from special steel, are carefully milled, heat treated, hardened and tested. The *Handles* are forged spring steel. The *Chains* are proof-tested to ⅔ catalog strength (1,200 lb. to 40,000 lb.). "Reversible" Jaws give double jaw life. "Standard" Jaws have extra bearing on the handle and forged in chain guides. The "Ideal" Tongs have V shaped teeth for a sure grip on irregular shapes, fittings, etc.

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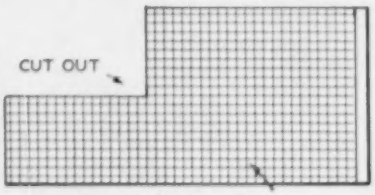
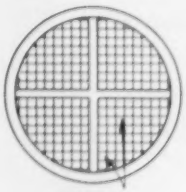
PIPELINE PATROL



STRAINER BASKET is cut back to clear the cutting blades.



STRAINERS need cleaning once every 10 days.

The strainer basket, meanwhile, is cut back so as not to interfere with the cutting blades. All oil being pumped passes through the strainer, and the motor is operated as required to rotate the blades.

Using strainers in conjunction with the cutters, it is possible to reduce cleaning time to once every 10 days.

The procedure followed is to operate the cutter until a tank is pulled down to about 5 to 6 ft. from the opening level. The cutter is taken out of operation until the tank is pulled down 9 to 10 ft. It is then placed back in operation until after the tank change has been made and the second tank in line is pulled down approximately 5 to 6 ft. as mentioned. The normal operating time for the cutter is about 18 hours on and 24 to 30 hours off following this procedure.

Method suggested by L. A. Morrison, district station supervisor, Pampa, Tex. Courtesy Humble Pipe Line Co.

FOR ENGINEERS

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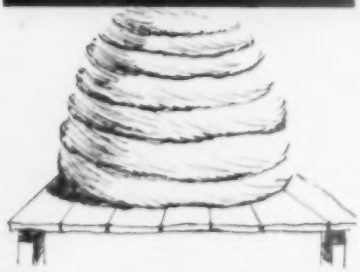

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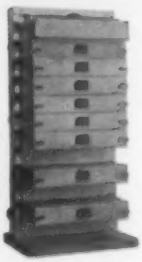
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OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . **plus:** special, precast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

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"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

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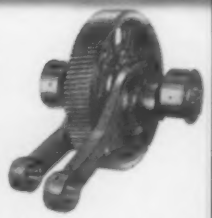
6 big reasons

WHELAND HP-18000 Heavy Duty Power Slush Pumps give extra performance!

Crank

One-piece steel casting heat treated. Compact eccentrics integral with crank give increased throw.

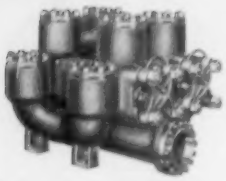


Crank Assembly

Strong and compact. Carburized helical main gear. One-piece steel connecting rods. Roller bearings throughout.

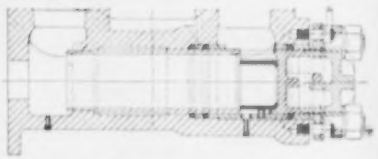
Wheland's Improved (Patented) Cast Steel Pot Covers

Feature metal-to-metal contact and independent gasket adjustment . . . saves time and gaskets.



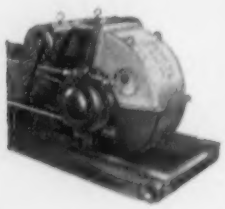
Fluid End

Simplified 1-piece steel casting with low-slung suction pot and short, streamlined fluid passages.



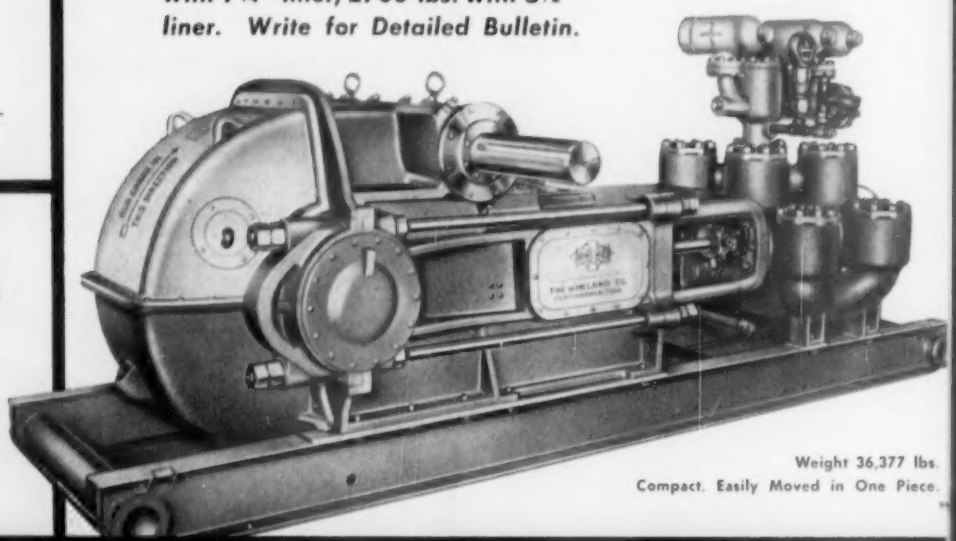
Patented Liner Retainer

and shoulder in fluid end holds liner with metal-to-metal contacts on both ends. Independent gasket adjustment from the outside saves time and gaskets.



Fool-proof, trouble-free splash lubrication system. Reversible pinion shaft.

Wheland HP-18000 Duplex Power Slush Pump—7¾" x 18" 750 HP Nominal Input at 60 RPM—1322 lbs. mud pressure with 7¾" liner, 2700 lbs. with 5½" liner. Write for Detailed Bulletin.



Weight 36,377 lbs. Compact. Easily Moved in One Piece.

Oil Circulating Screw Type Stuffing Box

Screw type gland maintains perfect alignment of packing with fluid rod. Easy to adjust and assures longer life for packing and water piston rod.

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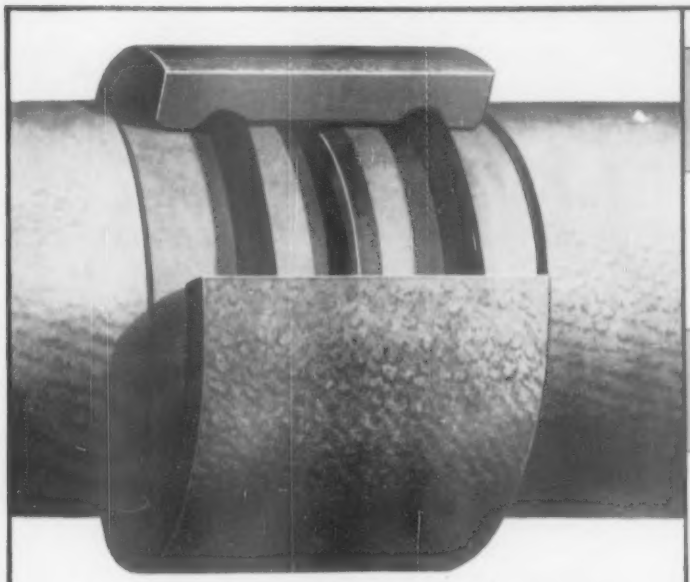
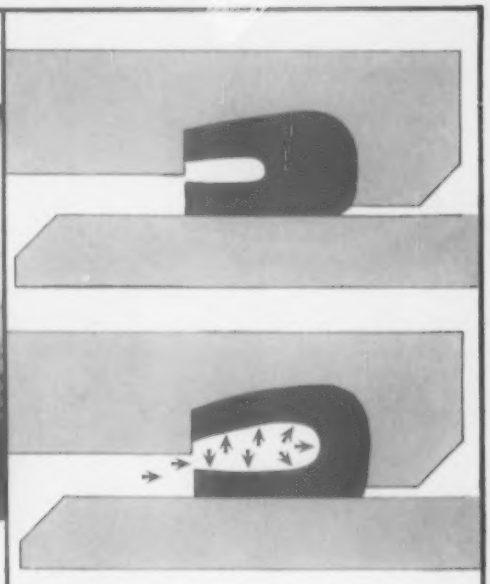


"CENTURY" ASBESTOS-CEMENT "FLUID-TITE" COUPLING (sectioned). Make-up speed results from holes in tapered "Fluid-tite" sealing rings. Holes permit rings to compress, allowing pipe ends to slide into coupling easily and without a special puller.



ACTION OF FLUID PRESSURE ON SEALING RINGS. Fluid enters pipe; internal pressure on holes in sealing rings causes rings to expand. The greater the pressure, the tighter the seal.

Three men use a new coupling method to make up "Century" A-C Pipe at the rate of

19 Feet Per Minute in Soggy Mud

A three-man crew recently made up over ¼ mile of six-inch "Century" Asbestos-Cement Pipe in 1¾ hours. Their accomplishment is believed to be a record, especially since the pipe was laid in mud under weather conditions which might ordinarily have washed out the whole operation.

Speed of make-up was made possible by the new "Century" Fluid-tite Coupling. Its special sealing rings are designed to permit easy compressibility, allowing pipe ends to slide into the coupling without special equipment. Contracted during installation, the rings expand when fluid enters the line. The higher the pressure, the tighter the seal.

Lightweight "Century" A-C Pipe with Fluid-tite Couplings can be positioned and made up in the field with minimum crews. Except for the largest diameters, no coupling pullers are necessary.

"Century" pipe itself offers all the tested qualities of Asbestos-Cement for oil country use. It is non-corrosive and non-tuberculating. This, plus its exceptional strength, has long made "Century" pipe the oilman's choice for carrying salt water, sour crude and fresh water, especially in areas of selective corrosion.

Write today for Bulletin No. A-C 456 giving full details on the new Fluid-tite Coupling. You will also receive a free copy of the Asbestos-Cement Pipe Flow Chart, hole punched on heavy board for your notebook.

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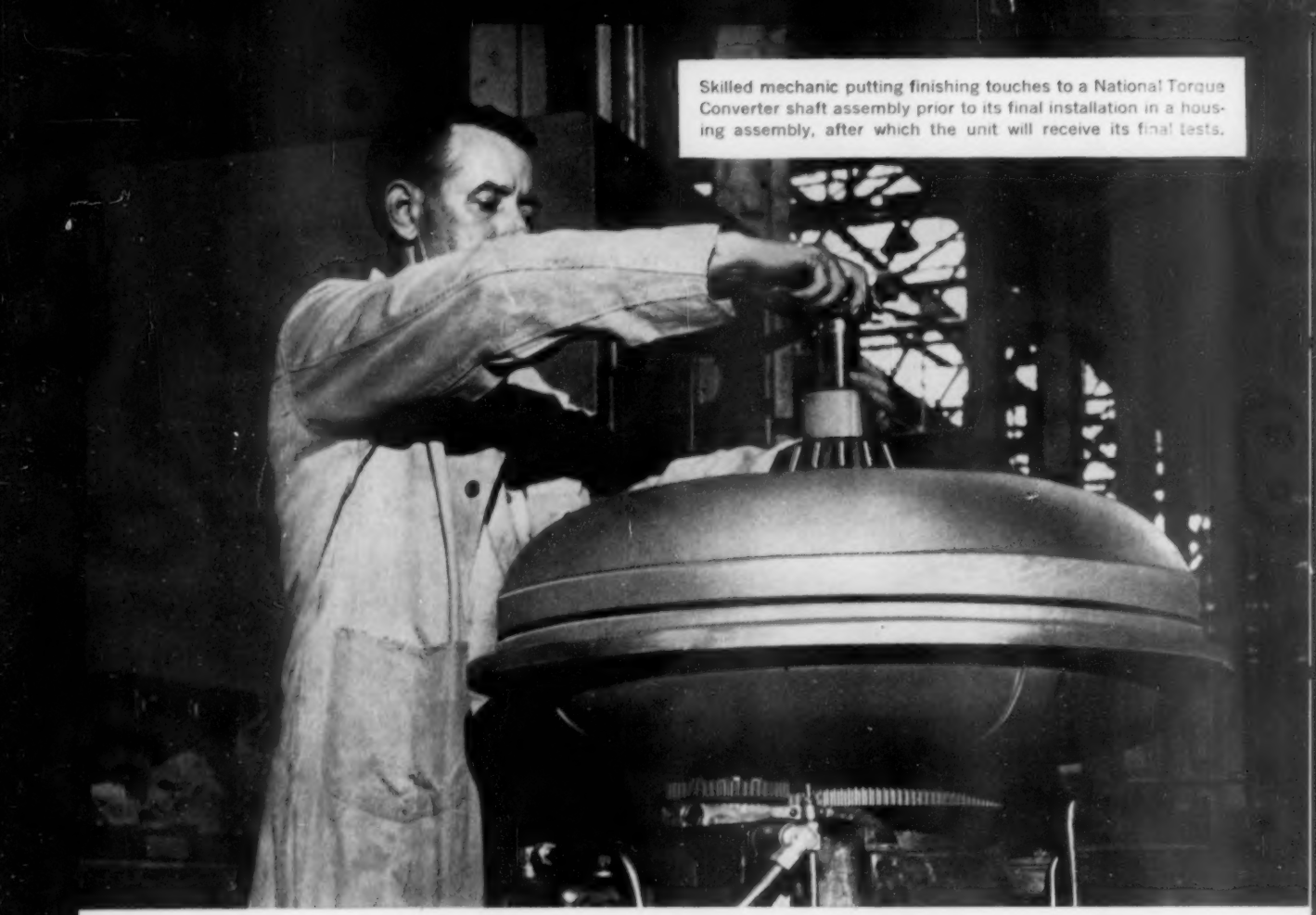

Skilled mechanic putting finishing touches to a National Torque Converter shaft assembly prior to its final installation in a housing assembly, after which the unit will receive its final tests.

The National Torque Converter is a dependable "constant horsepower" unit

Simple design, rugged and durable . . . precision parts assembled by skilled, experienced mechanics . . . standard and special tests of parts, of sub-assemblies, and of completed torque converters

That is why National Torque Converters provide uniformly smooth transmission of power from engine or motor to the job or load. All the shock of quick starting and fast acceleration of the load is absorbed hydraulically by the torque converter. This enables the engine to attain its optimum speed quickly and to deliver its full horsepower constantly . . . and without lugging or stalling.

Result: Job or work cycles will be completed faster and your equipment will deliver more work per unit per operator per day . . . every day . . . with minimum maintenance . . . with extended service life. It can be truly called a "constant horsepower" device.

Each National Torque Converter is a complete, integrated unit tailored to the application. And with a choice of 6 basic hydraulic circuit sizes, each with a range of input ratings, the National Torque Converter can be matched exactly to prime movers of 100 to 1000 hp in a wide variety of industrial applications; construction, excavating, drilling, earth-handling, logging, and mining equipment.

Why not let a National Supply engineer study your power-transmission problems and tell you just how National Torque Converters can help you? Or send for a copy of our Bulletin No. 468.

THE NATIONAL SUPPLY COMPANY

INDUSTRIAL PRODUCTS DIVISION

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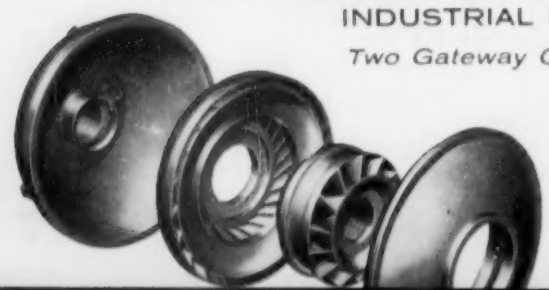
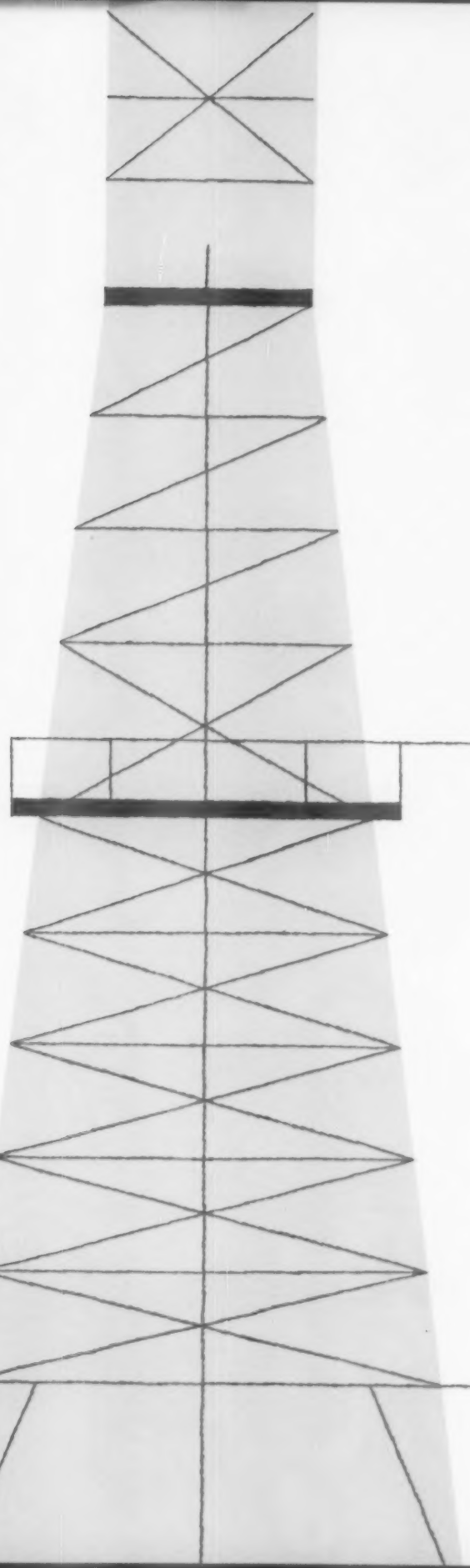
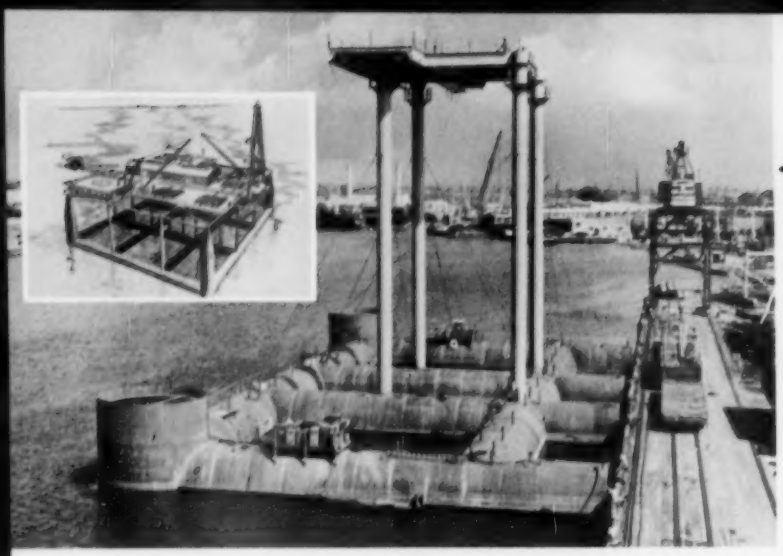


Pace-setters in the progress of industrial power transmission



Everything in sight is DIESEL-ELECTRIC

A report on rig construction at Orange, Texas

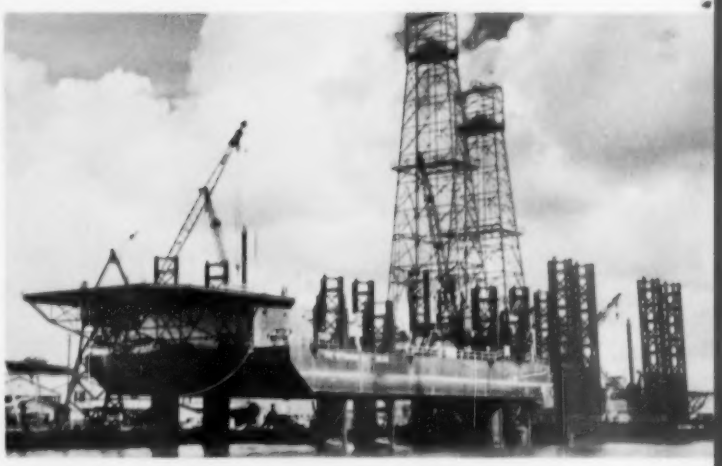


1

Shown here is Kerr-McGee's Rig No. 47, a mobile type of drilling device under construction by American Bridge Division of U. S. Steel. Three Electro-Motive Power units will be located on the rig, supplying power for mud pumps, drawworks and rotary table. Due for completion late this year, the drilling device brings to three the number of Electro-Motive Powered rigs for Kerr-McGee.

2

Rigs No. 54 and 55 for Offshore Company are shown here nearing completion in the American Bridge yards of U. S. Steel Corp. These mobile drilling barges, each powered by three 875 hp. Electro-Motive Power units, are capable of operating in waters up to 100 feet in depth. Each barge measures 200 feet long and 104 feet wide and contains eight hydraulically operated, 225-foot supporting legs.



3

This tender, one of four being converted for a major oil company, is shown at the Levingston yards at Orange. A former LST, the tender features a heliport and is completely outfitted with modern eating, sleeping and recreation facilities for the crew. Two 12-cylinder Electro-Motive Power units rated at 1200 hp. each will be located in the tenders to power large mud pumps.

4

The Penrod Drilling Company's W. H. (Bill) Dordan, a submersible island drilling barge, powered by 3 Electro-Motive units, is one of two recently christened. Built by the Levingston Shipbuilding yards, the Dordan is now drilling for Placid Oil Company near Houma, Louisiana. The second Electro-Motive powered barge, the Tom Sorrell, is also completed and drilling for Placid Oil Company in Lake Washington, La. Both of these barges are capable of drilling 18,000 feet in 19 feet of water.

Six Rigs – Four Companies – All Diesel-Electric

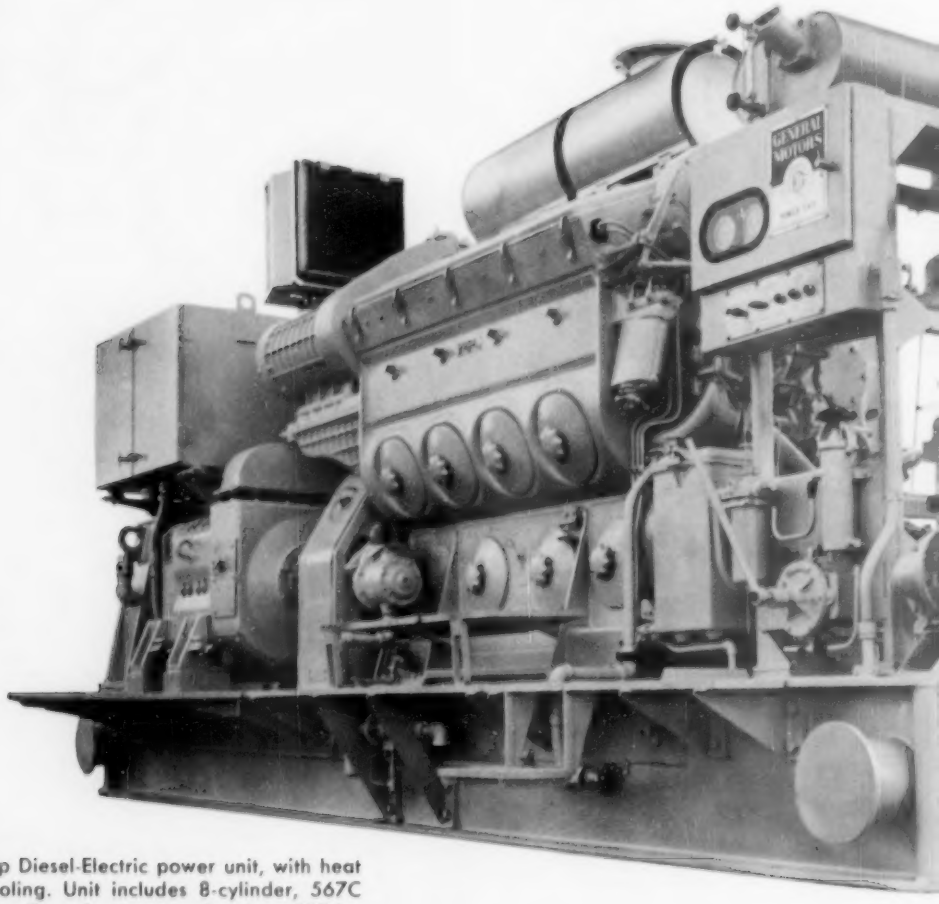
. . . and **ALL ELECTRO-MOTIVE POWERED**

We had this aerial view of the yards at Orange, Texas, taken for just one reason. It tells more literally than words how Electro-Motive Power is being accepted in the drilling industry everywhere. In this one photograph, there are six offshore drilling platforms or tenders in various stages of construction for four different concerns. All have one major thing in common: *each is equipped with Electro-Motive Diesel-Electric Power.*

If your interests lie with deep-well drilling on land, or with offshore drilling, the next few pages will tell you why Electro-Motive Power is rapidly assuming the position of dominant leadership in such applications.

ELECTRO-MOTIVE

offers new standards of flexib



SR8-W 900 hp Diesel-Electric power unit, with heat exchanger cooling. Unit includes 8-cylinder, 567C Diesel engine, all engine accessories, two 500-kw direct current generators, and generator control cabinet. All mounted on a steel sub-base, 21-feet long, 6-feet wide and 9-feet 7-inches high.

Completely Integrated Design

Each of the major components designed and built to work together—one manufacturer—one source of responsibility.

Maximum Portability

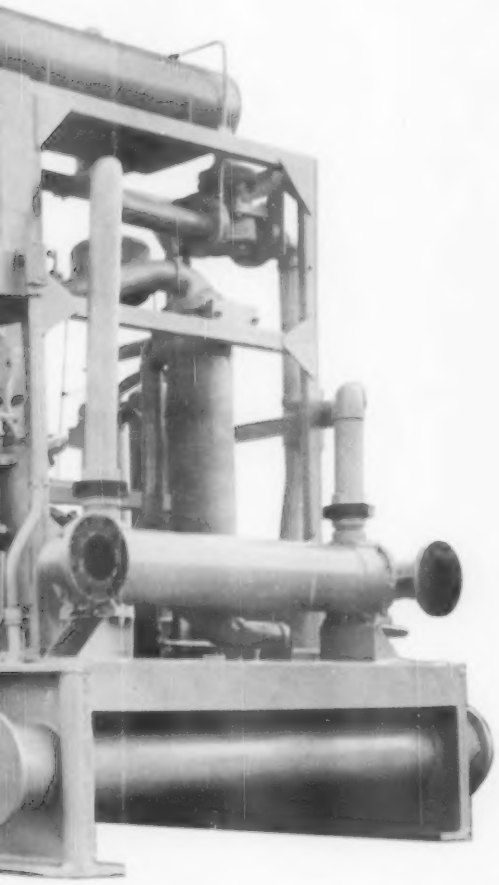
All components on skids with weight re duced to a minimum. Units are ruggedly built to withstand handling. No position problem— slashes setup and moving time on land rigs

Unmatched Flexibility

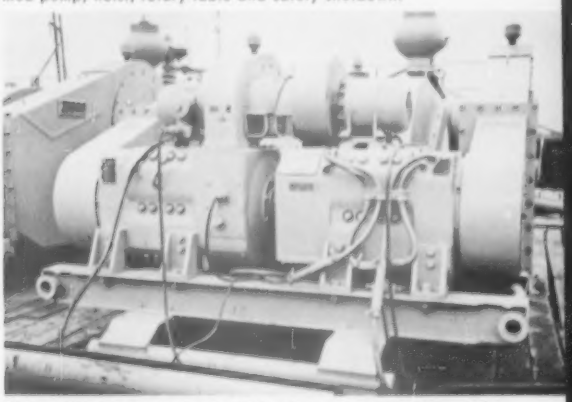
At a flick of the selector switch on the driller's control panel, power can be selected from one or more generators to meet any power requirement.

VE POWER

xibility, efficiency and economy



Driller's control stand is located most convenient to total operation. From a central position, the driller has complete control of all Diesel-electric equipment, including engine speed, mud pump, hoist, rotary table and safety shutdown.



Motor-driven components. Drive for mud pumps, drawworks is supplied by 625 hp. direct current electric motors. These motors provide smooth and rapid acceleration of loads with positive control of speed and torque. They also permit fast setup because each is connected to the main generator through simple, flexible power cables.

Proven components. This compact electrical control cabinet utilizes components that have proven themselves in thousands of General Motors Diesel-Electric locomotives. The tested dependability of this equipment is your assurance of lower cost per foot of hole drilled, and longer, trouble-free operation.

eight re-
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and rigs.

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Simplified Control

Centralized position of all controls for driller's convenience—continuously variable drawworks speed control and complete rotary table torque control at the driller's finger tips.

Low Drilling Costs

Lower first cost and lower cost per well drilled. Smooth electric power—flexible control —means less down time, faster drilling.

Complete National Service and Parts Availability

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- *DEARBORN'S POLYAMIDE CORROSION INHIBITOR*
- *PERMANENTLY STABLE IN BRINE*

WHAT ENDCOR IS: It is a specific chemical treatment for control of corrosion in both sweet and sour wells. ENDCOR 50 is a strongly polar type polyamide corrosion inhibitor incorporated in a non-oil-soluble, water-dispersible liquid carrier. ENDCOR 50 is not a salt. It is a stable molecular compound. At normal dosage levels, this inhibitor does not promote emulsification but instead acts as an emulsion breaker.

HOW ENDCOR 50 WORKS: When introduced into the annulus of a producing well, ENDCOR 50 passes through the casing oil layer and rapidly disperses in the underlying brine. When thus dispersed, ENDCOR 50 will be preferentially absorbed as an impervious film on metal surfaces of pumps, tubing, rods and flow lines. This provides positive protection against corrosive elements in the oil or brine.

FULLY FIELD TESTED: The outstanding performance efficiency of ENDCOR 50 has been thoroughly demonstrated by standard laboratory methods as well as by extensive field tests. A sample is available upon request.

Dearborn Chemical Company has been a leader in the field of corrosion prevention and water conditioning since 1887. During this time, Dearborn has supplied the oil field industry not only with NO-OX-ID® Coatings and Wrappers for the protection of pipelines, but also with boiler water and cooling water treatment in refineries.

Dearborn®

COMBATTING CORROSION WHEREVER IT OCCURS

MAIL THE COUPON for your copy of Dearborn Bulletin 5500-A. It gives all the facts on ENDCOR 50.

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ELECTRIC MOTORS
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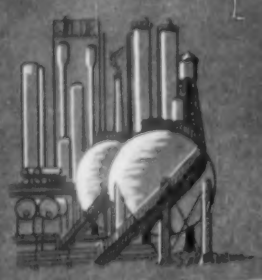
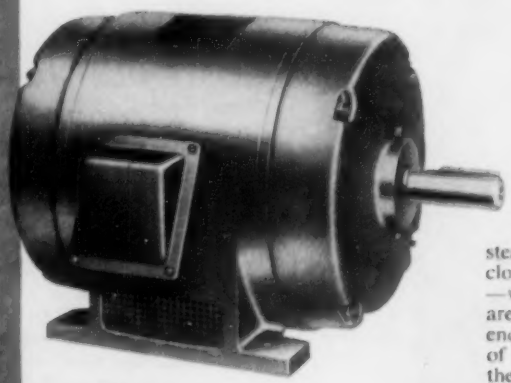
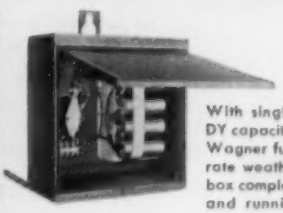


there's a Wagner Motor for every job



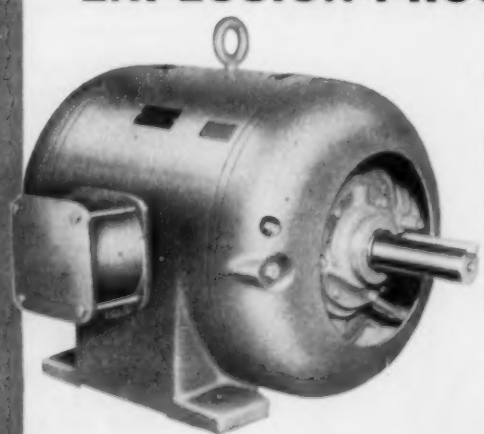
OIL WELL PUMPING MOTORS

Wagner cast-iron frame oil well pumping motors, either polyphase or single-phase, are especially designed for rugged, steady, outdoor service. The enclosures are completely drip-proof —virtually splash-proof. Air intakes are located at the bottom of the endplates to admit a cooling flow of air to the motor, while retarding the entrance of water. Outlets are located at the base of the frame, one on each side. Screened openings keep reptiles or small animals from entering the motor. The conduit box is moisture-proof and dust tight. For locations where only single-phase current is available, Wagner can furnish high power factor type capacitor-start motors with the same enclosures. You can get Wagner Oil Well pumping motors *from stock* in your immediate area.



With single-phase Type DY capacitor start Motors, Wagner furnishes a separate weatherproof control box complete with starting and running capacitors and voltage relay.

EXPLOSION-PROOF MOTORS



These powerful Type JP polyphase motors are expressly built for applications in explosive atmospheres. They are approved for Class 1 Group D hazardous locations. Totally-enclosed fan-cooled construction, with frames and endplates of cast iron, makes them suitable for indoor or outdoor use and for installations where corrosion is a problem. Available in ratings through 250 hp.

For full information, write for Bulletins MU-132 and MU-137. Thirty-two branch offices are ready to assist you in any motor application problem.

Wagner Electric Corporation
EST. 1891

M56-13

Wagner Electric Corporation
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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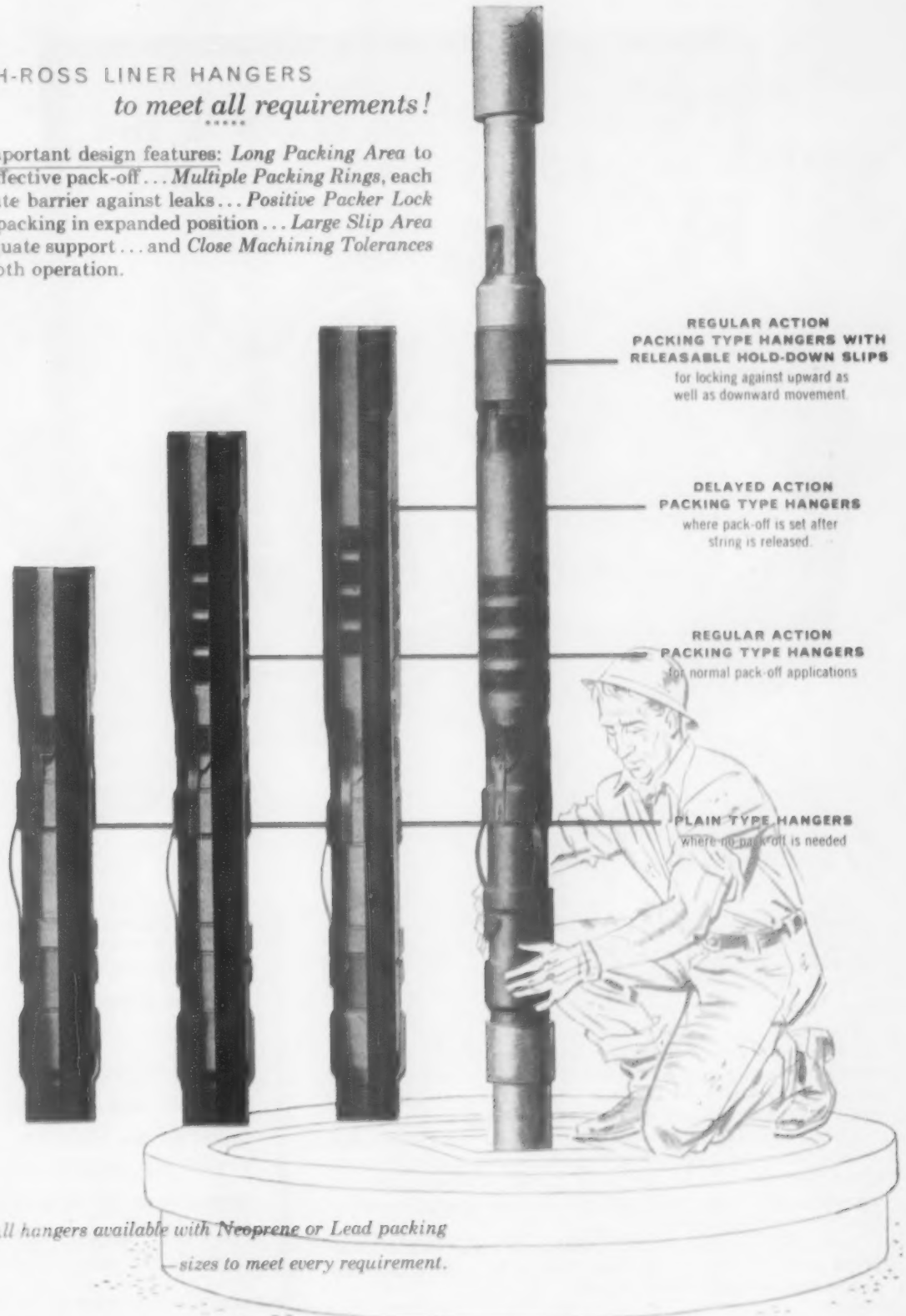
Note important design features: *Long Packing Area* to insure effective pack-off . . . *Multiple Packing Rings*, each a separate barrier against leaks . . . *Positive Packer Lock* to hold packing in expanded position . . . *Large Slip Area* for adequate support . . . and *Close Machining Tolerances* for smooth operation.



All hangers available with Neoprene or Lead packing

sizes to meet every requirement.

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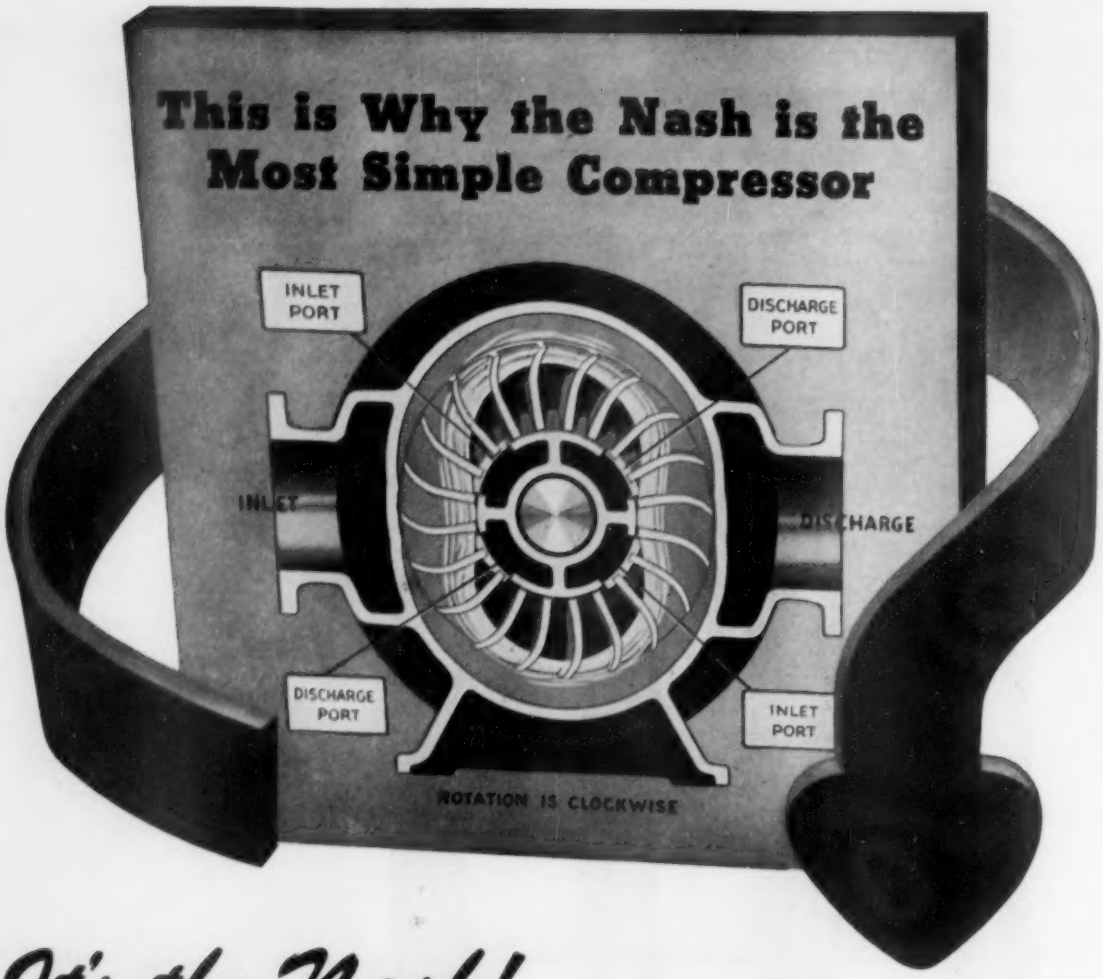
This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.

HOW TO—

stop mud valve troubles on drilling rigs

Switch to
Competitively-priced,
Rockwell-Built **MUDWONDER**
Valves for ALL Mudline Services

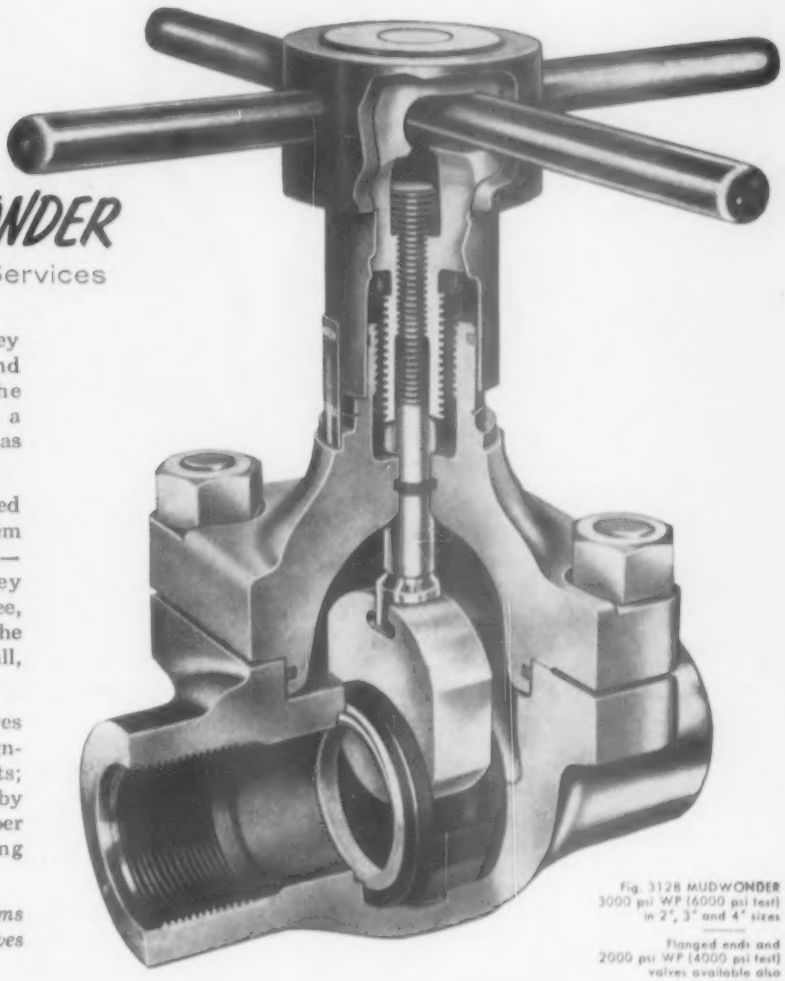


Fig. 3128 MUDWONDER
3000 psi WP (6000 psi test)
in 2", 3" and 4" sizes

Flanged ends and
2000 psi WP (4000 psi test)
valves available also

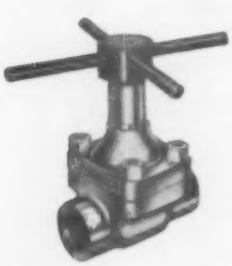
You no longer have to waste money and time rigging, maintaining and repairing old mud valves. Now, the Rockwell-Built MUDWONDER with a minimum number of wearing parts has completely proved itself.

Drilling men who have purchased MUDWONDER valves and have used them on their rigs—yes, even abused them—are switching to MUDWONDER. They know the MUDWONDER as a trouble-free, long wearing valve. They found the MUDWONDER more economical to install, to operate, to maintain.

What makes MUDWONDER valves so good? Three things—proper designing by valve engineering specialists; proper selection of part materials by valve metallurgical specialists; proper manufacturing by valve building specialists.

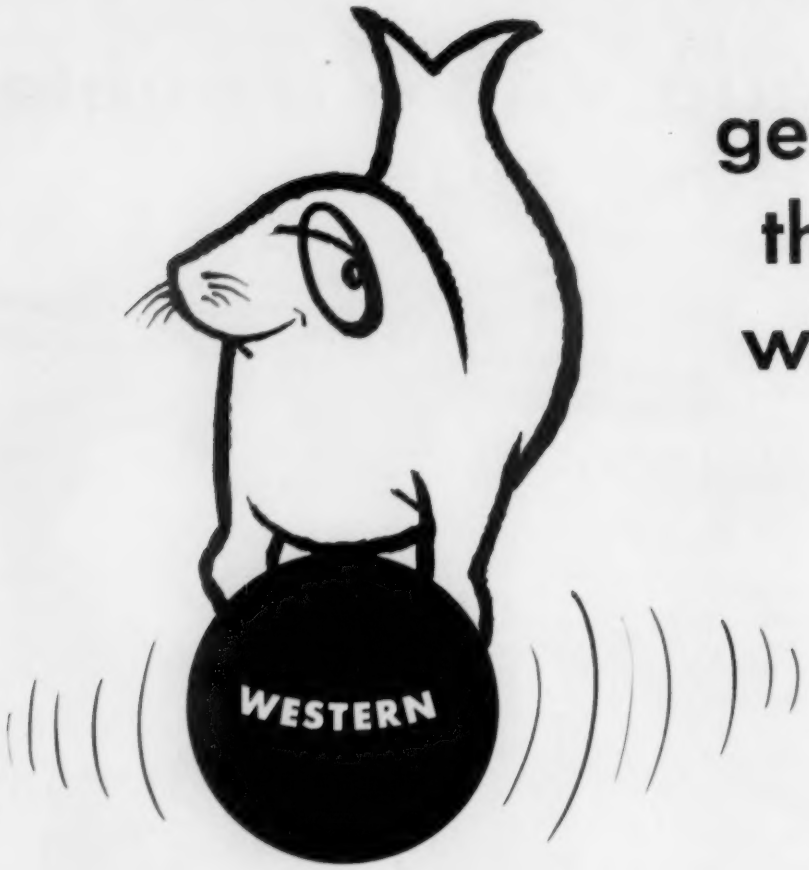
Stop mudline flow control problems today. Replace troublesome mud valves with MUDWONDER *now.*

You can expect the Rockwell-Built MUDWONDER to: SLASH DOWNTIME ... CUT MAINTENANCE ... GIVE LONGER SERVICE ... OPERATE EASIER, FASTER ... KEEP MUDLINES INTACT ... STOP SANDING-UP



Ask your favorite oil field supplier for more information or write to Edward for Catalog 12-S.

Edward Valves, Inc.
Subsidiary of ROCKWELL MANUFACTURING COMPANY
1212 W. 145th Street, East Chicago, Indiana



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PERFORATION BALL SEALERS

Perforation Ball Sealers are engineered for superior fracturing and acidizing.

They bring to the oil industry a controlled, effective and economical treatment on ONE set-up. In wells with one-zone or multiple-zone conditions, Perforation Ball Sealers temporarily seal off the most permeable interval to divert treating fluids into the tighter zones for complete treatment.

Injected into the treating line at the well head, Ball Sealers are quick and effective, saving treatment time and expense. Ball Sealers are experienced workers, proved in wells throughout the Southwest.

Their use cuts to a minimum the multiple use of down-hole tools and ineffective chemical blocking agents. With a Perforation Ball Sealer treatment, there is minimum danger of interzone communication. Reduced differential breakdown pressure eliminates most of the stress on cement job during treatment.

Pressure logs, Radioactivity Tracer logs, and recovered balls all prove the effectiveness of Perforation Ball Sealers.

Give your well the treatment that is proved for EFFECTIVENESS, ECONOMY and SIMPLICITY — with Perforation Ball Sealers from The Western Company.

For engineered well services — logging, perforating, fracturing and acidizing — GO WESTERN!

THE WESTERN COMPANY

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Mid-Continent Supply Company gives faster service—and improves efficiency—with expanded General Electric two-way radio system

General Electric 2-way radio base station at the Snyder, Texas store handles calls to and from radio-equipped field vehicles in the area. Rig operators want fast action—Mid-Continent cuts time & mileage delays—gives superior service.

DOWN-TIME on an oil rig costs big money. To keep operating, oil men depend on the fast-moving parts and supply services provided by Mid-Continent. In turn, Mid-Continent relies on a recently expanded General Electric two-way radio network to maintain contact with field men working the oil field sites. Supply and service vehicles, equipped with mobile radio, speed customer service by cutting time and mileage delays.

Radio Now Serves Mid-Continent In Five States

Mid-Continent now operates 13 narrow-band G-E transmitters, feeding signals to 89 mobile units in a five-state area. Stores in Texas, Oklahoma, New Mexico, and parts of Colorado and Nebraska are in constant contact with their field men. An emergency repair call relayed to a mobile unit sends a man, or a part, on the way to the job site in a matter of minutes.

New General Electric Progress Line Radio

New Progress Line radios offer complete plug-in chassis design, chassis interchangeability, and they operate on 6 or 12 volt power. Only General Electric mobile radios feature the new 6600 series tubes—manufactured and pre-tested for absolute dependability in 2-way radio circuits. Ask your G-E Communications Counselor for the full details, or, write: *General Electric Company, Communication Equipment, Section X8106-8, Electronics Park, Syracuse, New York.* In Canada, write: *C. G. E. Electronics, 830 Lansdowne Avenue, Toronto.*

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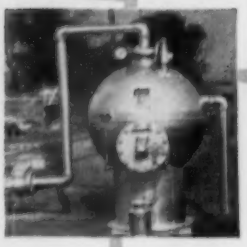

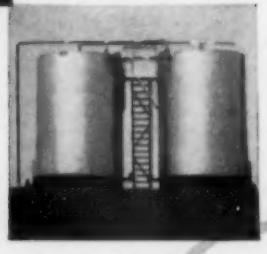

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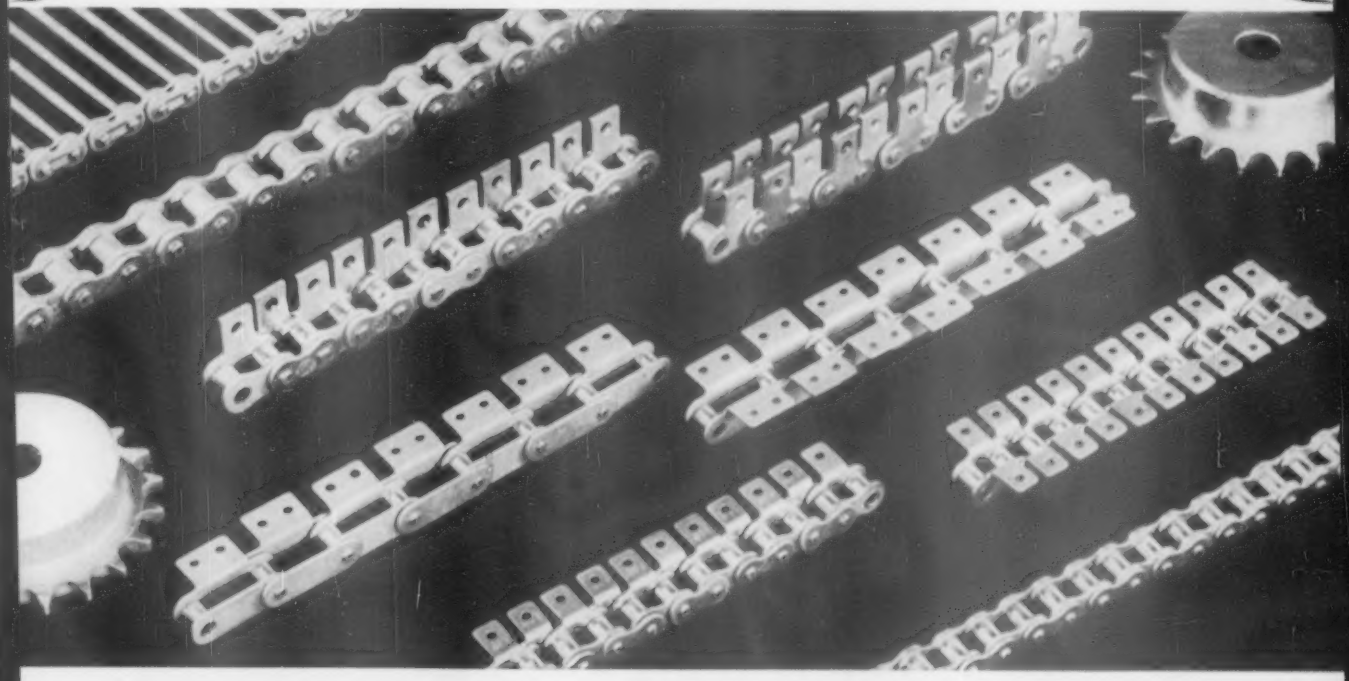

ATLAS ROLLER CHAIN

CORROSIVE RESISTANT...COSTS 40% LESS
COMPARATIVE TESTS PROVE IT WEARS 100% LONGER

From coast to coast manufacturers, engineers and transmission drive specialists are acclaiming this as the most revolutionary development in the roller chain field. It meets the most exacting requirements of the chemical, food, beverage and other industries where corrosion resistance is a factor. Yet it has been tested and proved to outlast, outrun and outwear other chains even though it costs far less.

HIGHER TENSILE STRENGTH—has same tensile strength as alloy steel chain . . . much higher than bronze or stainless steel chain.

LONGER WEARING—actual wear-drive tests prove it lasts as much as 100% longer than alloy steel chain.

STAINPROOF, CORROSIVE RESISTANT—corrosion resistance is greatly increased in Electrolized Chain and compares favorably with any other corrosion resistant chain now on the market.

LOWER PRICE—of Atlas Chain makes it as much as 40% less in cost than any other corrosion resistant chain now on the market.

Here's the chain that makes it possible for you to re-evaluate the specifications of your transmission drives. From the standpoint of cost, efficiency and longer wear it allows you to specify corrosion resistant chain on drives previously ruled out due to high cost and short chain life.

You owe it to your plant to contact your nearest Atlas distributor to get the complete story on Atlas Electrolized Roller Chain and Sprockets. He can help you attain a new standard of efficiency on your transmission drives.

ATLAS CHAIN AND MANUFACTURING CO.
West Pittston, Penna.

GET THIS DATA ON ELECTROLIZED CHAIN

This free brochure tells you in brief question and answer form all about Electrolized Chain. Write for your copy today.

25,000 hours and more between overhauls!

...CLIMAX of course!

Steady, continuous service day after day is the kind of power that really pays off in the oil fields – the kind of power that you can be assured of when you buy a Climax.

BIG CHIEF DRILLING CO., OKLAHOMA CITY, OKLA., has this to say of their twelve Climax V-12's –

> "The service rendered us by these engines has been excellent and we expect to purchase Climax engines should we add additional rigs in the future. We consistently get approximately 25,000 hours of deep drilling between overhauls and certain engines have exceeded this performance considerably."

Stop in at your nearby Climax distributor today. He will gladly show you actual case histories of the many drillers in his territory who have also found that you can't beat a Climax for downright dependability.

Climax drilling engines operate on Natural Gas or Butane and are available in a range of sizes up to 600 H.P.

WHERE POWER IS YOUR PROBLEM - CLIMAX IS YOUR ANSWER

OUTSTANDING FEATURES OF CLIMAX V & K SERIES ENGINES

- All models have renewable cylinder sleeves.
- All intake and exhaust valves are free-to-rotate type.
- All crankshafts are supported by bearings on each side of each crankthrow.
- All connecting rods are rifle drilled for pressure lubrication of piston pins.
- All cylinder heads have Climax high-turbulence type combustion chambers which produce maximum fuel economy.
- All models have the Climax consistent design that makes possible maximum interchangeability of wearing parts.

climax BLUE STREAK ENGINES

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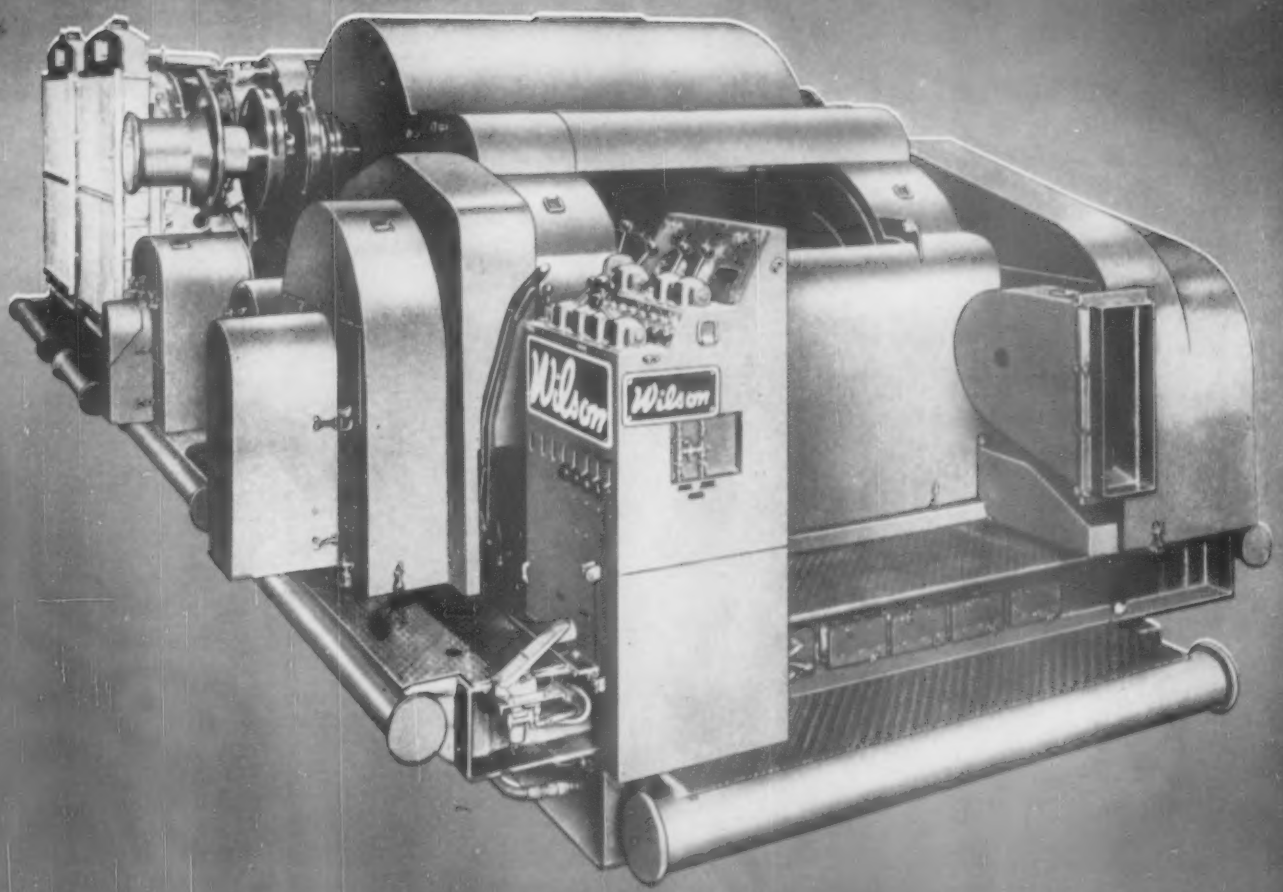
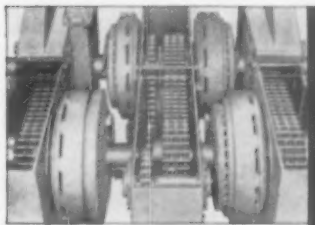
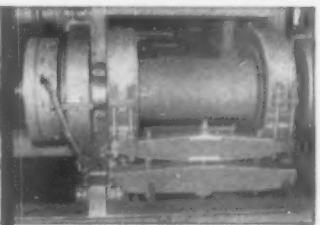
SUPER GIANT RIG



be modern - buy Wilson



- With New Three Speed and Reverse All Friction Clutch Transmission
- Available with Parkersburg 22" Single Hydromatic Brake Mounted on Transmission with 6 Speeds Between Drum and Brake—The Best Hydromatic Brake Arrangement Yet Devised!



- With New Beam Equalizer, Single Nut Adjustment Lever Type Brake which CANNOT KICK
- Oil Bath Drum Drive Chains Outside Frame
- High and Low Clutches on End of Drum Shaft
- Heavy Plate Chain Cases and Covers

Unquestionably...the most advanced and modern rig in the world today

You owe it to yourself to investigate this new and modern rig before buying

WILSON MANUFACTURING CO., INC.

Wichita Falls, Texas

the home of **RED IRON**

APV Company Lays in a Steep One Through Rugged Washington Terrain

Down Goes a Trencher

Here the 125-drawbar hp, 37,677-lb (as illustrated) HD-16 holds a trencher working down a steep hillside. Allis-Chalmers engine with follow-through combustion delivers plenty of power to take steep hillside work in stride.

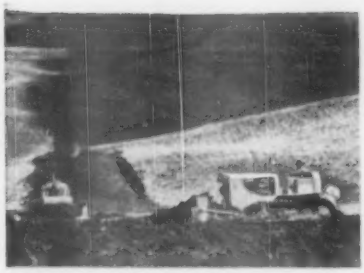
Fort Worth, Texas, Contractor Uses All Allis-Chalmers—Tractomotive Spread on 83-mile Plymouth to Goldendale, Washington, Job.

Forty-five percent grades, extremely rocky terrain and high winds that at times stopped operations completely made going tough, but APV's spread of Allis-Chalmers dozer tractors and Tractomotive-equipped side boom crawlers took it right in stride and kept this 26-inch natural gas line right on schedule.

Contractor Rates Allis-Chalmers Equipment "Excellent"

All tractors on the job are the newest Allis-Chalmers models, engineered with latest advanced-design features. Contractor A. P. Vaughn stated, "I rate Allis-Chalmers tractors excellent on every count. They've got the balance for steep hillside work; plenty of power; smooth, dependable torque converter drive for cradling, and there's nothing can touch them for easy maintenance. We didn't have a bit of tractor downtime on the entire job."

The spread consisted of three HD-21 crawlers, three HD-16's, and two HD-11's all with Tractomotive side booms; seven HD-16's with angledozers; one HD-11 tow tractor, another with backfiller. An Allis-Chalmers Model Forty Five motor grader handled final right-of-way leveling.



Preparing the R-O-W

Two HD-16's equipped with angledozers and winches are grading right-of-way ahead of ditching crews. Exclusive all-steel Box-A Main Frame makes possible better equipment mounting . . . superior over-all balance.

A Lift for the Stringers

An HD-16 helps a loaded truck up a 40% slope. *Ray Herron*, Supt. for Parkhill Trucking Co., Tulsa, Okla., says: "We think they're the best. We've bought a lot of them this year." Operator Ernest Kay adds, "You can't beat them as tow tractors. Torque converter makes winching easy to control."

Fast Line-up on the Rolling Hills

Easy does it with a 75-drawbar hp, 34,134-lb HD-11 with Tractomotive side boom on the job. Maximum lifting capacity is 40,200 lb at 4-ft overhang. Front-mounted power take-off from engine crankshaft permits side boom to work independently of tractor master clutch.

An Assist for the Bender

Here the versatile HD-11 holds a pipe section for the bending crew. Operator Jerry Stephens says, "Man, these are honest crawler tractors; you can't beat them. I don't think there's a tractor made that'll keep up with Allis-Chalmers side boom crawlers."

Smooth for Cradling

Here two HD-21's, 204 net engine hp, 78,250 lb each, cradle pipe for dope-wrap crew. Maximum lifting capacity is 127,000 lb at 4-ft overhang. Operator Elmer Pettus says, "No other tractor will keep up to Allis-Chalmers on this kind of work. I've run all of them and this is the best."

In Goes the Pipe

Two HD-16 torque converter tractors lower pipe. HD-16 has 150 net engine hp, weighs 57,840 lb, handles 77,580-lb maximum load. Tractomotive side boom features drop-proof counterweights; fully-enclosed internal expanding brakes; pin-connected frames for simplified servicing; easy-working, convenient controls.

HD-11 Speeds Backfilling

HD-11, equipped with backfiller, rolls right along on backfilling. Eighty-four-in. center-to-center tread width, up to 24-in. track shoes and long track with seven heavy-duty truck wheels give this crawler the balance and stability for long reaches.

Cleaning up Right-of-Way

HD-16 with angledozer cleans up right-of-way. Tractor puts in more hours on the job with features like simplified adjustments, fewer lubrication points and 1,000-hour lubrication periods for truck wheels, support rollers and idlers.

The Finishing Touch

Here an Allis-Chalmers Model Forty Five motor grader puts final grade on right-of-way. ROLL-AWAY moldboard reduces friction drag by rolling load up and ahead of the blade edge . . . makes more efficient use of engine power. Toggle-type controls give the operator finger-tip command of every blade position, every job.

ROLL-AWAY is an Allis-Chalmers trademark.

Check the picture highlights of the job. Then check with your Allis-Chalmers — Tractomotive dealer for all the big advantages that make Allis-Chalmers crawlers and Tractomotive side booms top performers on any spread.

TRACTOMOTIVE CORPORATION
DEERFIELD, ILLINOIS

TRACTOMOTIVE

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

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Joe—
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order me full set of
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drop-head dies I like—
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Every RIDGID Pipe Tool TESTED individually before shipment

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RIDGID 12R — ⅛" to 2"

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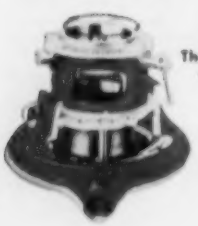
Handiest darned ratchet threaders you ever used!

Really handy, time savers, easy to use. Pick up the size head you need, snap it into the ratchet ring . . . and start threading! Heads can't fall out. Dies reverse easily for close-to-wall threading. Conduit and special dies available. Free carrier with sets. For perfect threads easily and long service, buy 'em at your Supply House.

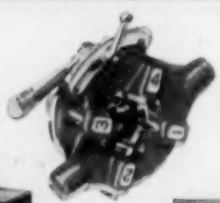
Carrier Free with Sets

Bolt Threaders, too—
ask for RIDGID OOR-B,
same easy-work advantages as drop-head pipe dies.

Whole Line of RIDGID Pipe Threaders Offers You Extra-Easy Threading



RIDGID
Jam-proof 65R
Threads 1" to 2" pipe with 1 set of dies.



RIDGID
504 Threader
for power drive use—threads 1" to 2" with 1 set of dies.

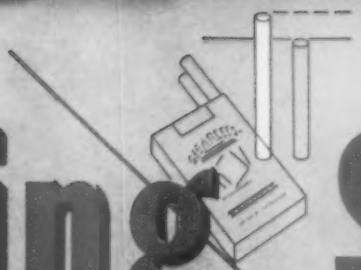
RIDGID
4P Geared Threader
2½" to 4" pipe—extra-easy handling, no upkeep.

RIDGID
Top Quality Sulphur-Lard Thread-Cutting Oil

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company • Elyria, Ohio, U. S. A.

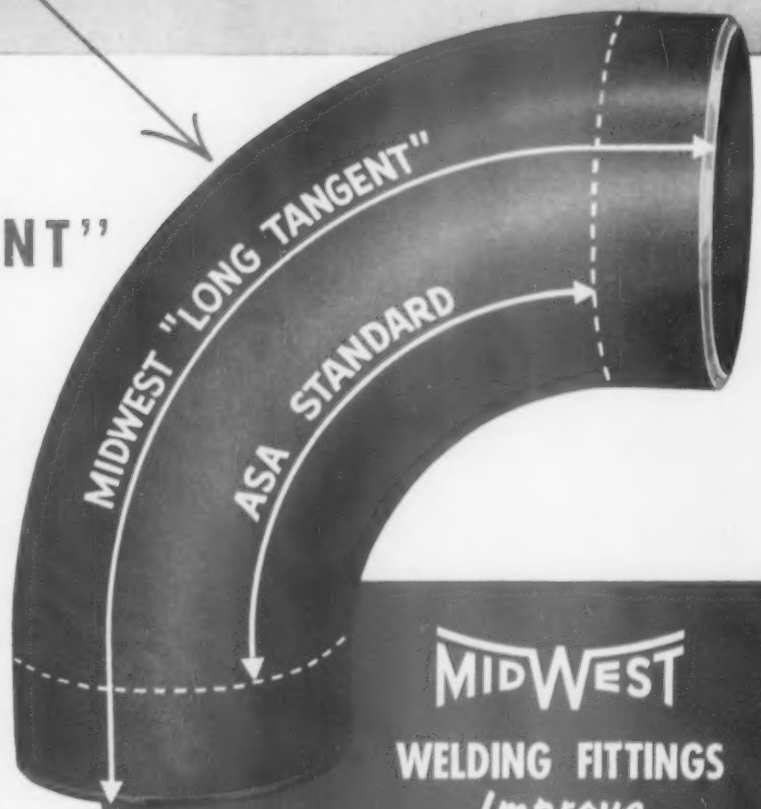
King Size (but at no extra cost)



MIDWEST

"LONG TANGENT" ELBOWS

Among all standard welding elbows, only Midwest "Long Tangent" Elbows can be described as *"King Size"* . . . only they have the long straight ends which equal ¼ of the nominal fitting diameter (a 12" Midwest "Long Tangent" Elbow has tangents 3" long). This greater length is responsible for significant savings on many piping systems (see advantages listed below). For additional information, ask your Midwest distributor or write us for Catalog 54.



MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Clifton, N. J. and Los Angeles

Sales Offices:
New York 7—50 Church St. • Chicago 3—79 West Monroe St. • Cleveland 14—616 St. Clair Ave. • Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg. • Miami 34—2103 Le Jeune Rd. • Boston 27—426 First St. • San Francisco 11—420 Market St.

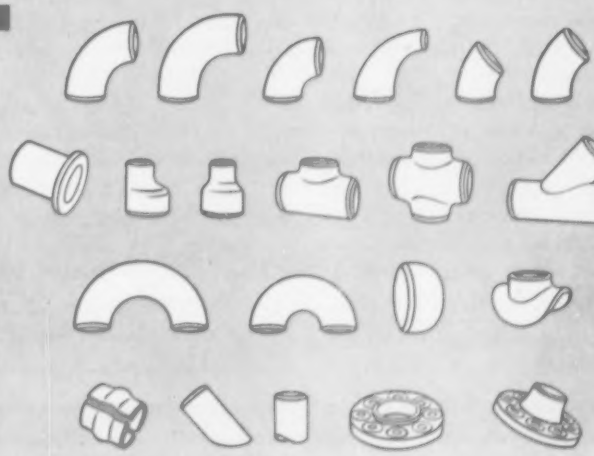
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST

WELDING FITTINGS *Improve* PIPING DESIGN and REDUCE COSTS

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS.



MIDWEST HAS THE MOST COMPLETE LINE

7323

Twin Disc's new SP-321 PTO

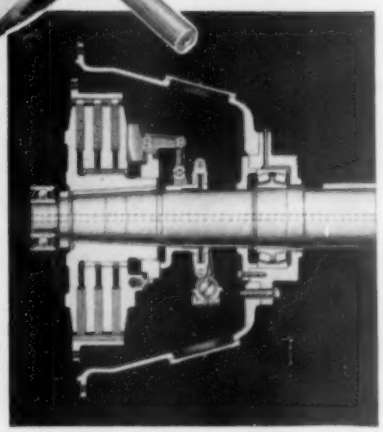
meets increased power requirements of modern industrial engines

Increased rpm. . . . increased hp output—that's the trend among industrial engine manufacturers. And that's where Twin Disc comes into the picture with its new SP-321 Power Take-Off—a friction clutch designed to meet the increased power transmission requirements of today's higher speed, higher horsepower industrial engines.

Unusually compact for its high capacity, this new PTO can handle up to 6730 lbs.-ft. of torque and transmit up to 602 hp at 1550 rpm. It's available with a standard SAE No. 00 flywheel housing adapter to meet the widest range of industrial power units in its hp and rpm ratings.

Other features include a triple driving-plate construction to provide ample friction surfaces to withstand excessive heat . . . a pilot bearing with double-width bearing race for greater lubrication retention and long life . . . and a spherical roller bearing at the clutch output shaft for greater overload and side-pull capacity.

The new SP-321 Power Take-Off—along with the recently announced SP-318 and SP-314—makes the Twin Disc line of heavy-duty friction power take-offs *the broadest, most complete line available.* For full information, write Twin Disc Clutch Company, Racine, Wisconsin. Request *new* Bulletin 308.



Twin Disc's new SP Power Take-Offs feature: counter-balanced engaging linkage; positive-type clutch engagement; pilot bearing with double grease shield; clutch plates with maximum friction area; spherical roller bearing; heavy-duty, oversize output shaft; easily adjusted clutch through pin and adjusting ring.

TWIN DISC

TWIN DISC

Friction Clutches and Fluid Drives

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES OR SALES ENGINEERING OFFICES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • TULSA

It's the DIFFERENCE

You *Can't* See that Counts!

It's easy to distinguish Naylor pipe from other light weight pipe by its familiar spiral. But what you can't see from the outside is the extra performance built into this lockseamed, spiralwelded pipe.

Once you use Naylor for gas gathering and field processing piping, the difference in service becomes apparent. First, the extra strength and safety you get . . . because of the spiral truss which acts as a continuous expansion joint to absorb shock loads, stresses, and strains. Second, the greater collapse strength . . . which permits operation under either vacuum or pressure.

Remember, too, that this Naylor structure maintains its true cylindrical form and holds its diameter accurately. Naylor Spiralweld comes in diameters from 4" to 30" and is available with standard weight pipe ends for faster, stronger field welds.

Write for Bulletin No. 507 or call our distributors.

NAYLOR PIPE

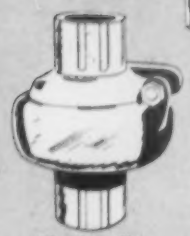
NAYLOR PIPE COMPANY
1232 East 92nd Street
Chicago 19, Illinois

Exclusive Distributors in
Mid-Continent and Gulf Coast Areas
MID-CONTINENT SUPPLY CO.
Ft. Worth, Texas and Branches

Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Malleable Couplings

Gas Line Blowdowns



"Flexi-Ball" Joints

"Big Inch" Couplings

Forged Steel Couplings

Scraper Trap Couplings

Adjustable Wing Valves

Tees

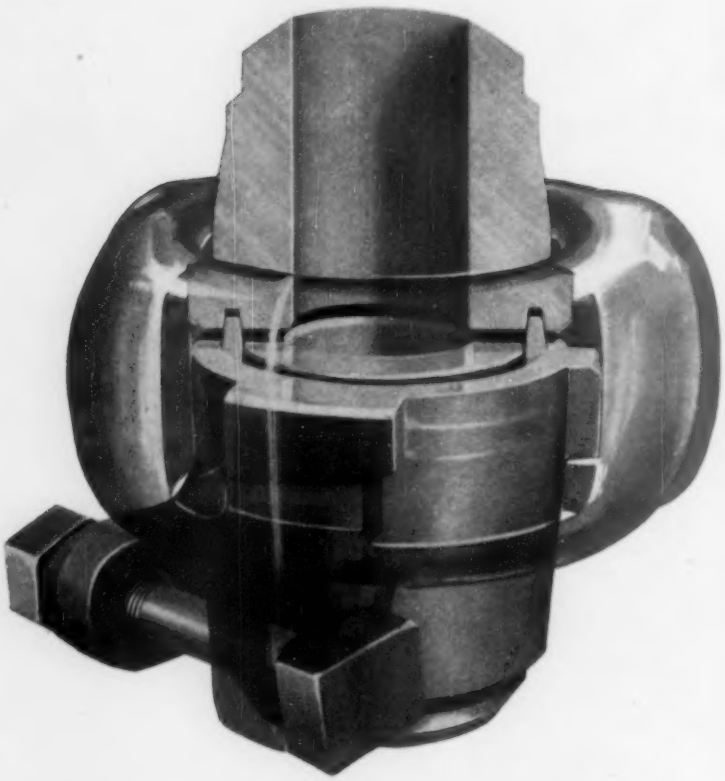
Christmas Tree Flow Manifolds

Crosses

Positive Choke Bodies

UNIBOLT

–lightest–strongest and busiest coupling in the oil world



Lightest because its design rules out bulk, such as flanges, multiple bolts and nuts, hammering lugs, etc. It effectively uses every ounce of steel. The result: minimum weight, maximum compactness for lower cost handling and ease of installation.

Strongest because, size for size, the UNIBOLT design places more metal in shear.

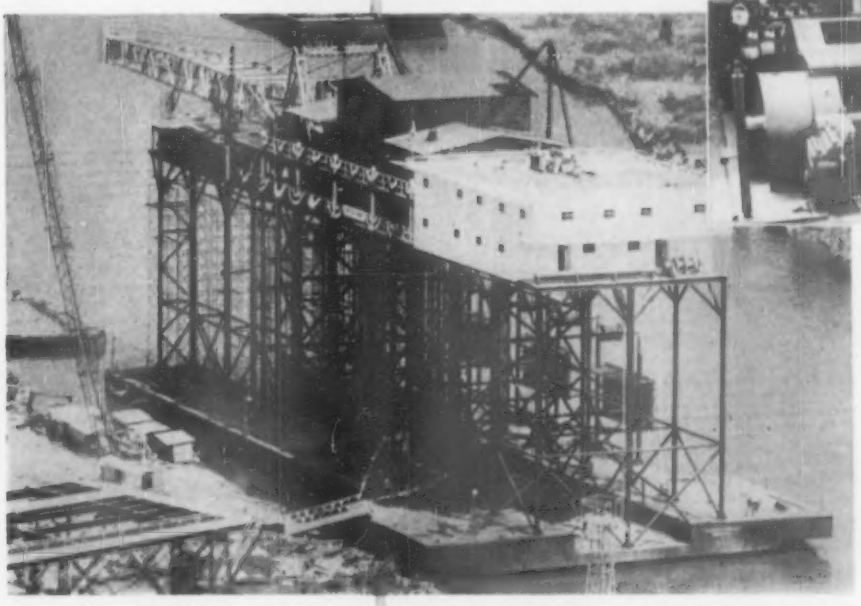
Busiest because it has replaced flanges and threaded connections on all sorts of Christmas tree fittings, rotary hose connections, and pipeline equipment.

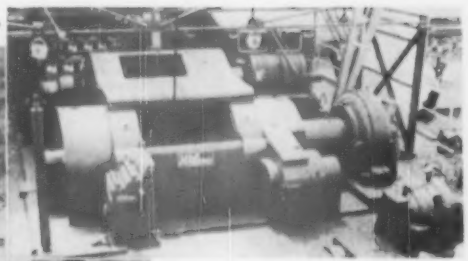
The cutaway view presented here graphically illustrates how the mating tapered shelves on the lug hub and nut member are drawn together in a wedging action by a single bolt (two bolts on large sizes). Thus, by means of leverage, tremendous pressure is applied to seats and seal ring, the latter being available in steel, gasket material, or self-sealing rubber, depending on service conditions. The bolt is under initial stress only. Hubs may be threaded or provisioned for welding.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS.

the world's largest offshore drilling rig is LeBus Grooved . . .

MORRIS & HAMILTON, INC.

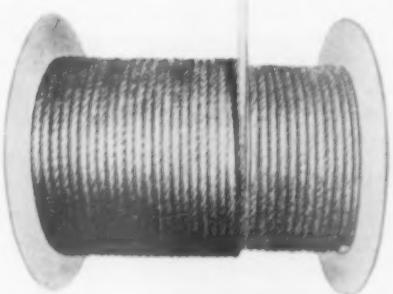




Above is the Wilson Super Titon "66" drawworks which was equipped with LeBus Counterbalance Grooving at the Wilson Factory.

The "Carter Mart" Morris & Hamilton's mobile drilling platform No. 12 is the largest self contained offshore drilling platform afloat. Here it is just before moving to its location off the coast of Louisiana.

Another example of the confidence drilling Contractors have in LEBUS COUNTERBALANCE SPOOLING. The "Carter Mart" is only one of the many Morris & Hamilton rigs that is equipped with LEBUS SPOOLING SYSTEMS. Wherever you go, you'll find LeBus Grooving has become so important that rig owners as well as manufacturers of hoisting equipment are rapidly standardizing on this revolutionary method of spooling wire line. The main reasons being to reduce wire line wear to a minimum and increase the speed and efficiency of the drawworks. Make sure your drilling hoists are operating properly . . . by insisting that they are equipped with LEBUS COUNTERBALANCE SPOOLING.

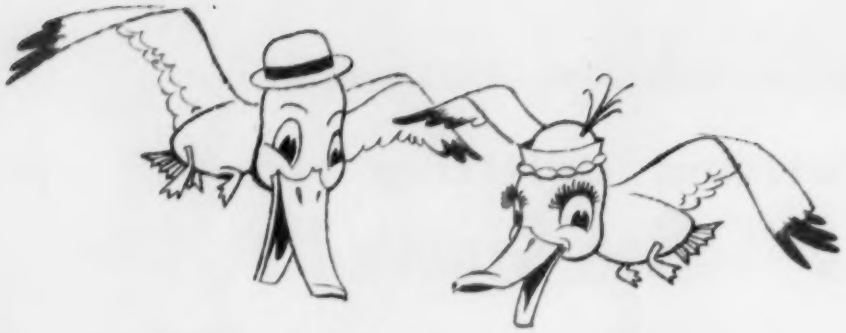


Manufacturers Note:
Write for complete facts on how you can install LeBus grooving in your plant under LeBus License Plan.

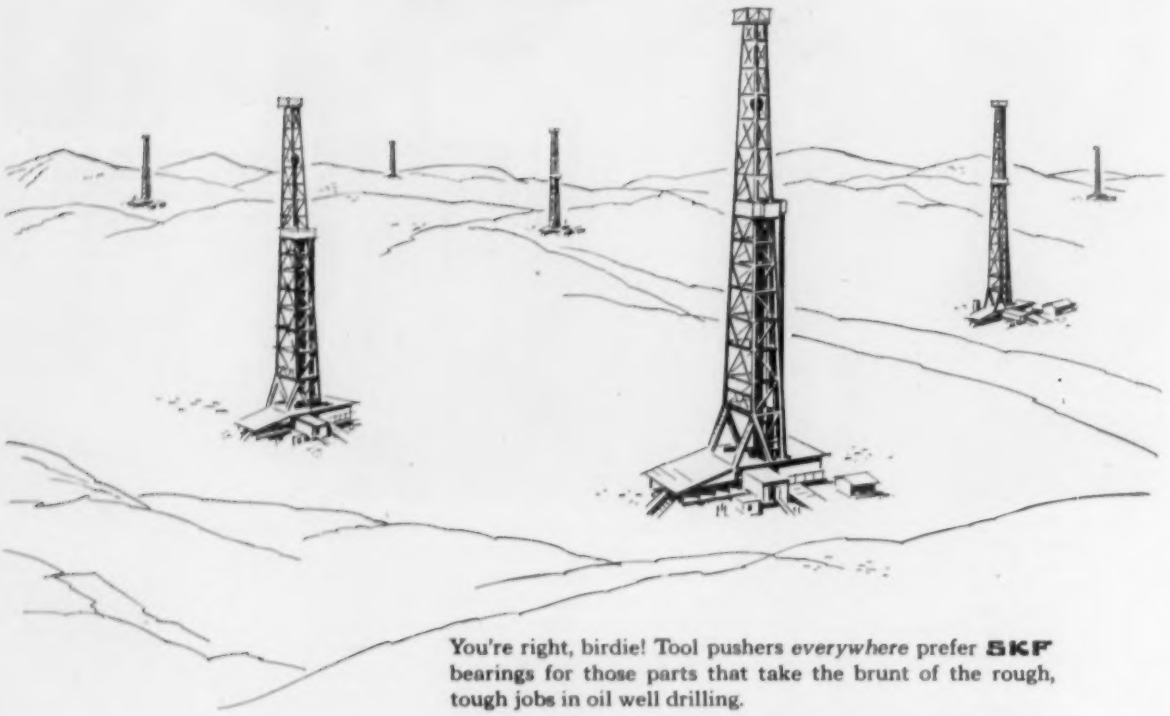
Patent Nos.: Counterbalanced Spooling, Nos. 2,734,695; 2,732,150. Controlled Parallel and Helical Spooling, Nos. 2,708,080; 2,620,996. Appli. of grooving, Nos. 2,599,926; 2,204,938. Removable End Fillers, No. 2,216,819. Other patents pending.

LeBus International Engineers, Ltd.

Executive Offices: 305 Wichita National Bank Building, WICHITA FALLS, TEXAS
Sales, Service Control and Warehouse Stock: LONGVIEW, TEXAS



That tool pusher is a smart duck
...using **SKF**® bearings



You're right, birdie! Tool pushers *everywhere* prefer **SKF** bearings for those parts that take the brunt of the rough, tough jobs in oil well drilling.

The reason is obvious: every **SKF** bearing is designed, engineered and manufactured to meet the most rigid standards ...you can rely on their performance. And because **SKF** makes *all* basic types of bearings, you get unbiased advice on anti-friction problems from field engineers who are specialists on drilling equipment.

You can look confidently to **SKF** to help you put *the right bearing in the right place.* 7759

SKF

EVERY TYPE—EVERY USE

- *Ball Bearings*
- *Cylindrical Roller Bearings*
- *Spherical Roller Bearings*
- *Tapered Roller Bearings* ("Tyson")

* Reg. U.S. Pat. Off. Tyson Bearing Corporation

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

Powell Lubricated Plug Valves

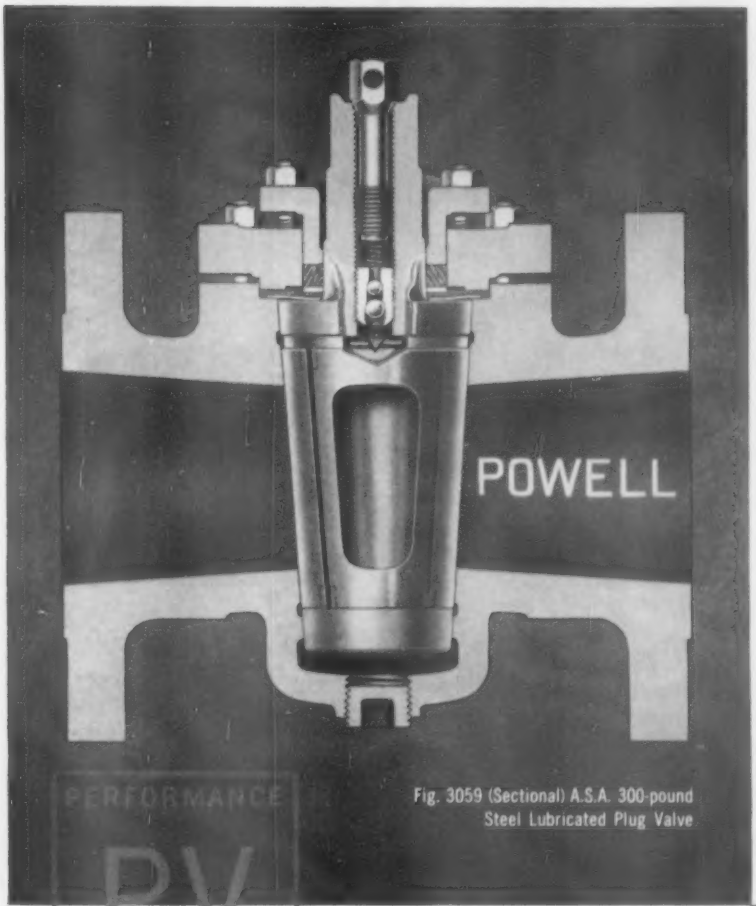


Fig. 3059 (Sectional) A.S.A. 300-pound Steel Lubricated Plug Valve

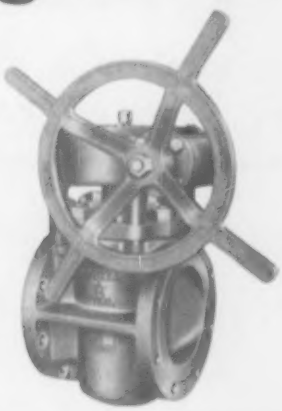


FIG. 1559G—150-pound Steel Lubricated Plug Valve. Gear operated

FIG. 2200—175-pound W.O.G. Semi-Steel Lubricated Plug Valve

PERFORMANCE PV VERIFIED

Powell Lubricated Plug Valves maintain the 110-year tradition of quality and precision. Only the finest available materials are used. And painstaking quality control is rigidly enforced through each and every step of manufacture.

Valve users who want one source of supply for lubricated plug as well as all types of bronze, iron, steel and corrosion-resistant valves will want full details on Powell Lubricated Plug Valves.

For example, features include quick and positive operation—just a quarter-turn to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed. Available in Steel and Semi-Steel through distributors in principal cities.

For full details, write for the new PV-4 Catalog on Powell Lubricated Plug Valves. Just fill out the coupon and mail. Of course there's no charge, no obligation.

THE WM. POWELL COMPANY
2525 Spring Grove Ave.
Cincinnati 22, Ohio

Gentlemen:

Please send me a copy of your PV-4 Catalog on Powell Lubricated Plug Valves. It is understood that there is no cost, no obligation.

*name*_____

*title*_____

*company*_____

*city*_____

*zone*_____ *state*_____

The source of supply for all valve needs!

POWELL VALVES...110th YEAR

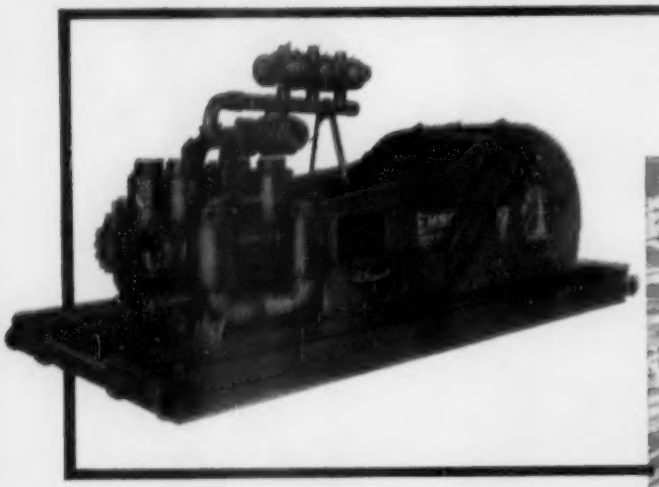
BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.

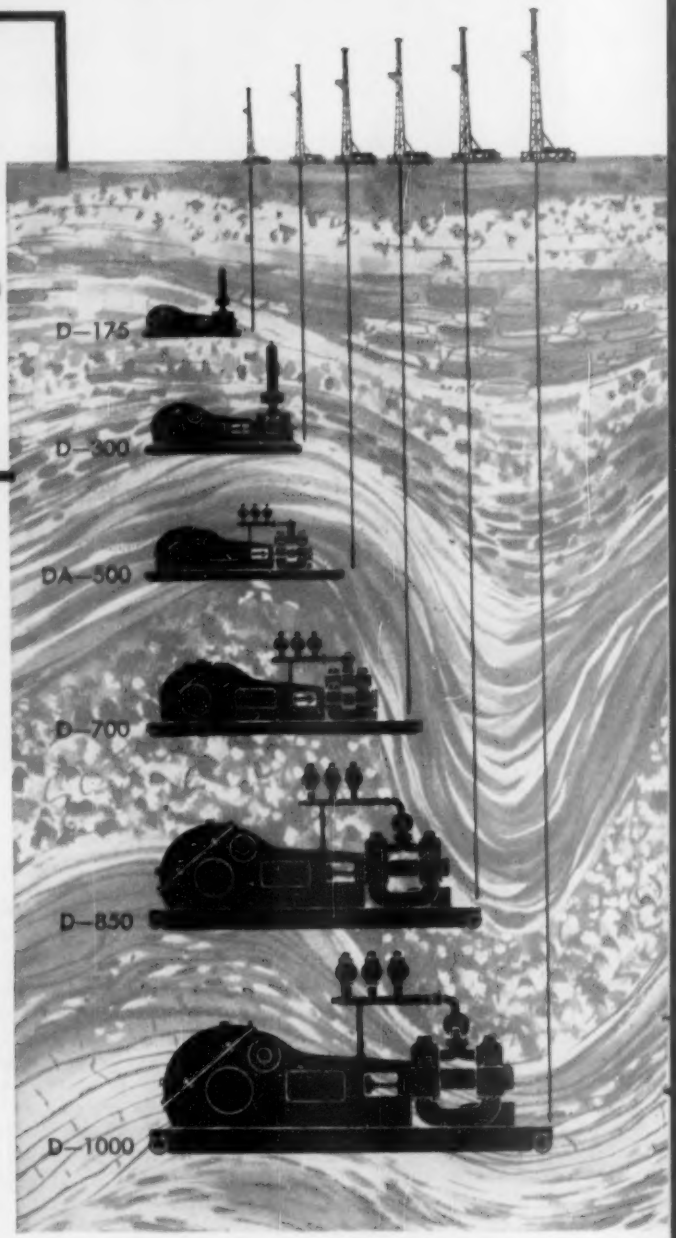
Dependable Performance • Advanced Design • Low Cost Operation

EMSCO SLUSH PUMPS

are available in sizes to meet every drilling requirement!

"Buy From Bovaird"





For jet bit, big hole or deep drilling, or for shallow or medium wells, you'll find an EMSCO Slush Pump available to meet your needs. Due to Fabriform construction of the power end, frame is rigid and lightweight, offering easier handling at the rig and less costly transportation. Lubrication is completely automatic. Exclusive patented "exposed" liners enable you to detect and correct liner packing leakage immediately before damage is done. Call your Bovaird representative for bulletins and complete information.

SUPPLY BOVAIRD COMPANY

PESA

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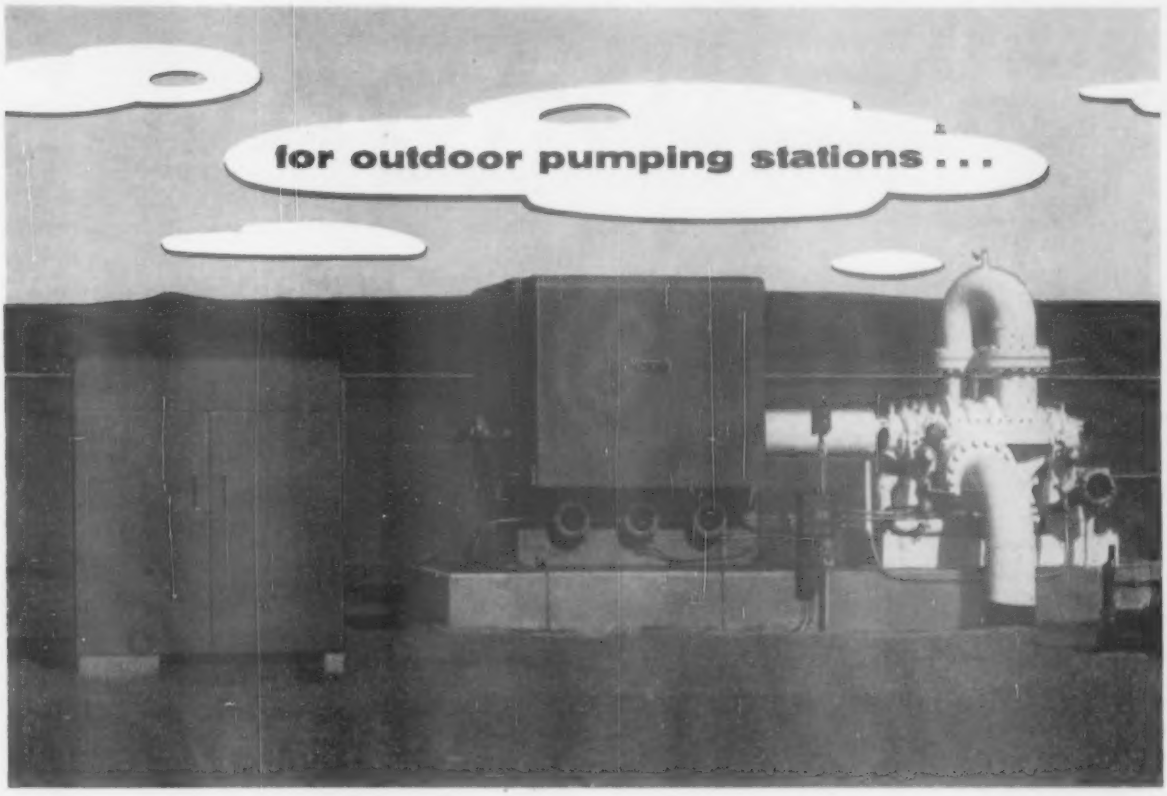
THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

85 YEARS OF PROGRESS WITH THE OIL INDUSTRY



no enclosures or special foundations needed with **ELLIOTT PIPE LINE MOTORS**

Through the use of Elliott Weather-Protected Motors, pumping stations are greatly *simplified* without sacrificing *dependability*. In the station shown above, an Elliott 1500 hp 2-pole 3600 rpm squirrel cage induction motor is direct connected to a two-stage oil pump. This motor is specially designed for pipe line service, and is so completely weather-protected that no special house or enclosure is required.

The motor bearings are flood-lubricated by a self-contained system which includes a geared pump, oil filters, and an air-to-oil cooling system within the motor housing. Temperature detectors protect both bearings and motor windings. Space heaters inside the motor enclosure are energized when the motor shuts down, thus preventing condensation of moisture. Relays and controls are protected by glass-covered explosion-proof enclosures.

Based upon their satisfactory experience with weather-protected motors, this company has standardized on the simplified outdoor pumping stations rather than the more costly enclosed stations.

For further details, write Elliott Company, Ridgway, Pennsylvania, or consult your nearest Elliott District Office.

PG-22

ELLIOTT Company

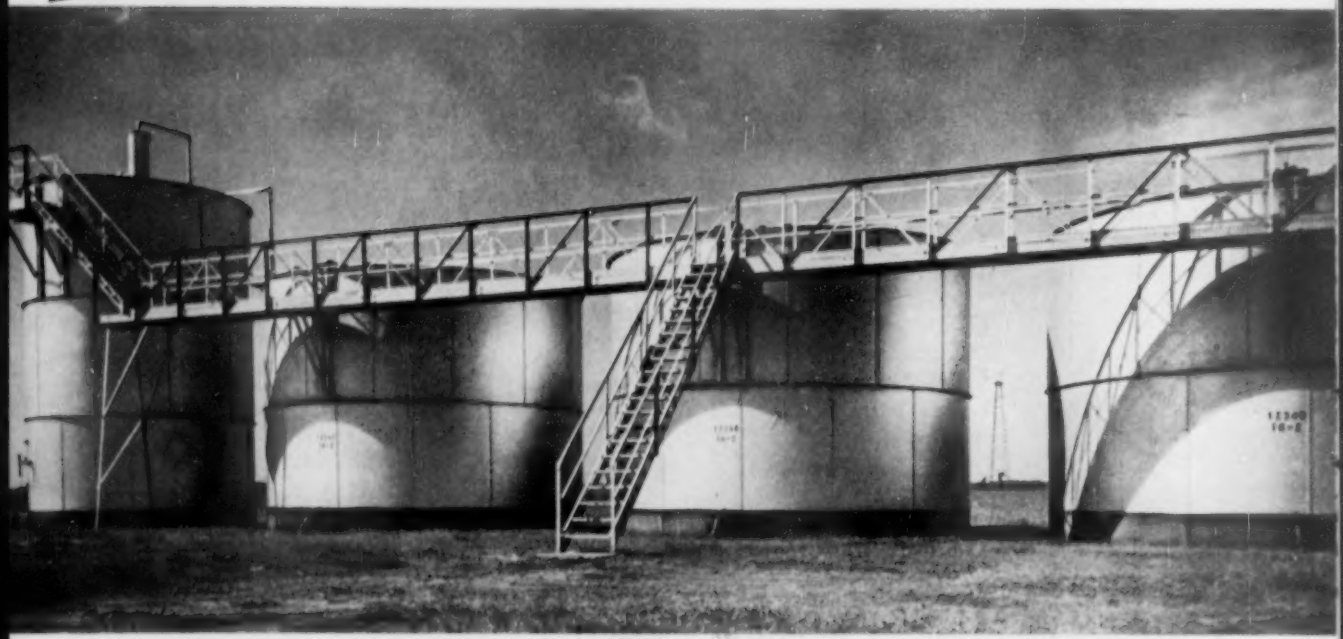
STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

PARKERSBURG BOLTED STEEL TANKS

give years of safe, trouble-free lease storage

Parkersburg Tanks are designed to API specifications and precision fabricated to insure accurate, leak-proof fit of every part. They all have Parkersburg's exclusive packing especially designed for safer crude oil storage. For added protection they have recessed washers and Neoprene rings for all vertical seams . . . aluminum decks and top rings to resist sour crude corrosion are optional. They are available with flat, cone or sump bottoms to meet your particular requirements.

For years of safe, trouble-free lease storage contact your Parkersburg Representative today.



Parkersburg
RIG AND REEL COMPANY
DIVISION OF PARKERSBURG : AETNA CORPORATION

3345 WINTHROP AVENUE
FORT WORTH 16, TEXAS

5624

EQUIPMENT MEN . . . in the News

Liberty Manufacturing Holds Sales Meeting

Officers, salesmen and manufacturer's representatives from a four-state area of Liberty Manufacturing Co. assembled recently in Fort Worth for its annual meeting. New developments and plant expansion in the manufacturing of Liberty pumping units and Texasteel sucker rods were discussed.

Attending the meeting were, front row: Sam P. Hamer, vice president; W. A. E. Woods, president; John H. James, secretary-treasurer; George W. Armstrong, Jr., chairman of the board; Jack Gale, Oklahoma City; Kenneth Barney, Fort Worth.

Second row: Eddie Rose, Odessa; Paul Nagle, Oklahoma City; John Ruff, Houston; Bill Ware, Fort Worth; Lowell Davis, Odessa; R. R. Estes, Denver.

Third row: Walter Beal, Odessa; Jim Wiley, Midland; J. J. Hargett, Abilene; Ralph McBurnette, Shreveport.

Davison Makes Industrial Chemicals Appointments

C. E. MEGINNIS

The appointment of Charles E. Meginnis as assistant sales manager and of Robert H. Herrmann as technical service manager of the industrial chemicals department has been announced by Davison Chemical Co., division of W. R. Grace & Co. John J. Kunkowski has been named field service engineer on industrial chemicals and assigned to the Chicago office.

Meginnis comes to his new post from Chicago, where he was district sales manager. Herrman has been in technical service and new-product development since 1950.

In 1952 Kunkowski joined the operations division of Davison. He has been in technical service for the company, specializing in silica gel and catalysts, since 1953.

L. C. Reid is sales manager of industrial chemicals, and A. R. Worrall is general manager.

Gary Named Fluid Packed Pump Latin American Agent

JACK GARY

The appointment of Jack Gary as Latin American representative for Fluid Packed Pump Co. has been announced by Don Vandenberg, sales manager. Prior to his present assignment, Gary spent the past 2 years in the Gulf Coast division of Fluid Packed Pump. In his new capacity he will make his headquarters at Maracaibo, Venezuela, working with National Supply on the distribution of Oilmaster products throughout Latin America.

Rogers Diesel Appointed Power Chief Distributor

Appointment of Rogers Diesel Engineering Co., Inc., New Orleans, as a distributor of Power Chief diesel and gas engines in the southern portions of Louisiana, Mississippi, and Alabama is announced by Nordberg Manufacturing Co., Milwaukee, Wis.

Rogers Diesel Engineering Co. is actively engaged in serving oil companies, drilling contractors, and the general marine field. Sidney F. Rogers is president of the firm. The other officers are: Clarence L. Johnson, vice president; Wayne F. Traverse, secretary; and John M. Couvillon, treasurer.

Rogers Diesel Engineering specializes in engine repairs and offers complete fuel-injection service. The full line of Nordberg Power Chief engines will be available from Rogers Diesel.

Alco Completes Building Program

The completion of a $2-million building and expansion program at its Beaumont plant, which will boost substantially production of heat exchangers and oil-field equipment, was announced in Beaumont recently by officials of Alco Products, Inc.

Alco now has a more modern and efficient plant to manufacture specialty items and to mass-produce heat exchangers and well-control equipment, according to plant manager, C. H. Homer, Jr. Repair facilities also are provided as are large warehouse areas to stock both products turned out in Beaumont and those from other Alco plants.

On recently acquired property north of the original facilities, Alco constructed a 6,000-sq.-ft. office building backed by a 14,000-sq.-ft. warehouse. The office structure houses executive offices, engineering and development personnel, marketing and general administrative offices.

Alco engineering at Beaumont is under the supervision of M. Wennerbom, Jr., production engineer, and

This is an exterior of the new Alco office building at Beaumont which contains 6,000 sq. ft. of of floor space. Housed here are the administrative, marketing and engineering sections.

E. F. Cooke, Jr., product development engineer. Wennerbom is concerned chiefly with the design and manufacturing of heat exchangers, while Cooke is in charge of oil-field equipment.

Alco has completely revamped its fabrication, assembly and machine-shop facilities. Features of the fabrication and welding department include a new 30-ft. stress-relieving furnace and a plate bending roll with a capacity of 20-ft. length.

The fabrication and welding department has 25,000 sq. ft. of working area. The machine department has 20,000 sq. ft.

Van Riper Appointed by BJ Service, Ryan Promoted

JOHN VAN RIPER

John Van Riper has been appointed fracturing supervisor for BJ Service, Inc., and W. W. Ryan has been promoted to station superintendent at Sweetwater, Tex., according to W. T. Box, vice president in charge of operations. Van Riper was formerly with Continental Oil Co. for 10 years, serving as district engineer in the Los Angeles Basin and Ventura districts.

Ryan has been with the BJ Service organization since 1952 and has held various supervisory positions. He recently returned from the company's main office in Long Beach, Calif., where he attended an advanced training program.

T. B. Lowary Joins Vinson Supply Board of Directors

T. B. LOWARY

B. W. Vinson, chairman, and J. M. McReynolds, president, have announced that the board of directors of Vinson Supply Co., Tulsa, has elected Thomas B. Lowary as a member of the board of directors. Lowary will also assume the responsibility of the newly created position of sales coordinator, which function has been made necessary by the continued growth and expansion of Vinson Supply Co. stores, the area served, and the scope of product lines.

Lowary became associated with Magnolia Petroleum Co. as a production engineer after graduation from college. After 3 years of service with Magnolia, he joined Vinson Supply Co. as a sales engineer in Oklahoma City in 1951. Transferring in 1953 to Odessa, where he served as assistant store manager, Lowary was brought into the Vinson Tulsa office in 1955.

Staff and District Managers Named by Chase

Allan R. Armstrong has been appointed staff manager of tube sales for Chase Brass & Copper. Named to a similar position for sheet and strip was John J. Vreeland. Herman H. Kremer has been appointed staff manager of rod and wire. Replacing Kremer as district manager at the Charlotte, N. C., sales branch will be Thomas E. Cox, previously a Chase salesman assigned to the St. Louis district. These personnel changes have been announced by George B. Moseley, vice president in charge of sales.

Armstrong, who has been in sales work with Chase since 1940, was transferred from the Chicago office to the company's Waterbury, Conn., headquarters. He had previously been in Waterbury from 1941 to 1943 as a member of the development and sales-promotion departments. Prior to that, he had been in sales promotion in the company's Boston office. Vreeland joined Chase in 1930 as research en-

5 YEARS
IN A
SALT FLAT

THIS PIPELINE IN LOUISIANA is subjected to conditions about as corrosive as you could find. Lying in salty muck, sometimes completely submerged, it is exposed to atmospheric temperatures varying from below freezing to over 100 degrees. When laid five years ago, this line was coated with our LION E-120. A recent inspection, made at the time this photograph was taken, showed the coating to be intact. No sign of disbonding could be found and there was no checking or cracking.

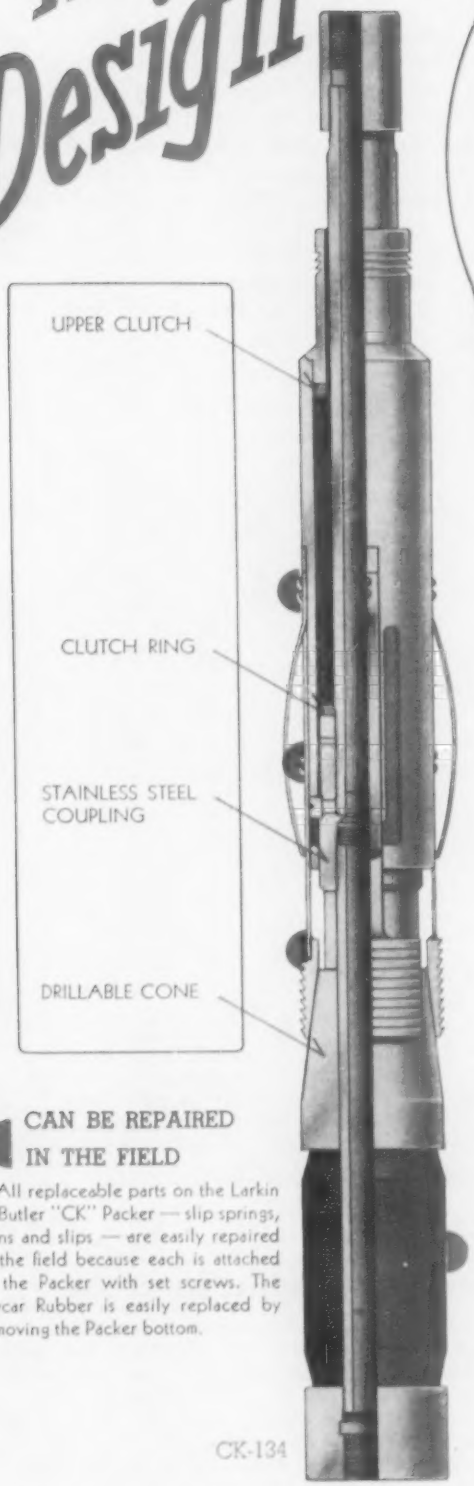
ABOVE GROUND OR UNDERGROUND *protect your pipelines with Lion E-120—one coating for year-round application. Write today for specifications and quotations.*

THE HOLCOMBE COMPANY, INC.
FIRST NATIONAL BANK BUILDING TELEPHONE 5-3468
SHREVEPORT, LOUISIANA
HOLCOMBE COMPANY OF CANADA, INC.
323 BARKER BUILDING TELEPHONE 6-7291
CALGARY, ALBERTA, CANADA

Lion Coatings • Holcombe Selenium Rectifiers
Pipe Wrappings • Graphite Anodes • Coke Breeze

NEW Design

greatly reduces the difficulties encountered in retrieving ordinary upside-down type Packers



CK-134

You can retrieve the Larkin of Butler "CK" Pressure Packer so much easier, both under normal and emergency conditions, you'll soon forget the troubles you may have had retrieving ordinary upside-down type Packers.

A flat angle taper on the cone and slips insures smoother, easier movement for setting and removal. The double thick Hycar Rubber also assures more positive removal.

Normally, the "CK" Packer is removed by lowering the tubing several feet and turning one turn to the right. Should this fail, a stainless steel back-off joint allows you to release the upper tubing mandrel. This exposes the circulating area and provides a jar action to dislodge the Packer. If extreme conditions above the Packer prevent removal in this manner — a second back-off is provided. The upper tubing mandrel releases entirely from the clutch ring, freeing the tubing string.

CAN BE REPAIRED IN THE FIELD

All replaceable parts on the Larkin of Butler "CK" Packer — slip springs, reins and slips — are easily repaired in the field because each is attached to the Packer with set screws. The Hycar Rubber is easily replaced by removing the Packer bottom.

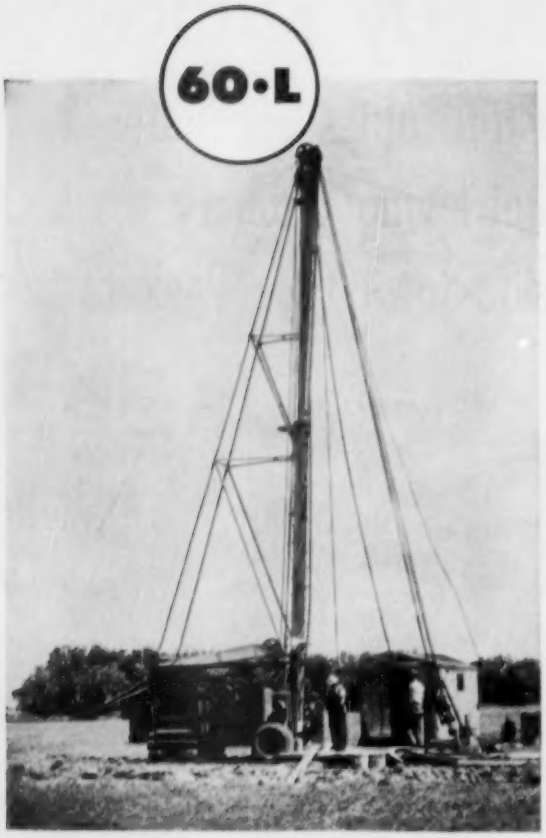
Wire, write or phone any Larkin of Butler office for more specific information.

LARKIN of Butler

LARKIN and COMPANY, INC. Butler, Penna.

Main Office and Plant	Butler, Pa.	Phone 23-770
Oklahoma Warehouse	Tulsa, Okla.	Phone Diamond 30-388
Illinois Warehouse	Olney, Ill.	Phone 25-651

SPOTLIGHTING TODAY'S



Top-to-bottom drilling to 1,500 feet; servicing to 2,000 feet; 2,750-lb. tool capacity.

SHALLOW WELL and WORKOVER SPECIALIST

A popular choice in shallow oil fields is the 60-L with its 48-ft. derrick. It features large reels that spool plenty of line, a power plant that fully matches machine capacity, and responsive controls that ease handling of casing loads to 40,000 lbs. (with casing tackle strut). Bull reel pulls 1,800 lbs. of tools from 1,800 feet in six minutes.

Outstanding performance, long-life construction, easy operation, ready mobility, and exceptional dependability — these are some of the reasons why there are more Bucyrus-Erie spudders in use today than any other make. These are field-proven facts that assure you extra profits on top-to-bottom drilling, workover, or drilling-in jobs. Note the capsule descriptions of each of these modern spudders. Consider the quality behind every component. Compare the brief specifications. Then, select the Bucyrus-Erie drill most adaptable to your needs.

For more information on the Bucyrus-Erie of your choice, see your local distributor or write direct. Do it soon!

35556

Top-to-bottom drilling to 2,500 feet; servicing to 3,000 feet; 3,700-lb. tool capacity.

MODERATE DEPTH DRILLING and SERVICING . . .

A real money-maker for contractors everywhere, the highly mobile 28-L can put down hole with both speed and efficiency. It has a strong, power-raised 54-ft. derrick of latticed box construction, a heavy-duty power plant, and ample spooling capacity. It handles static casing loads to 75,000 lbs. with auxiliary A-frame. Bull reel pulls 2,600 lbs. of tools from 2,500-ft. hole in approximately seven minutes.

BUCYRUS ERIE

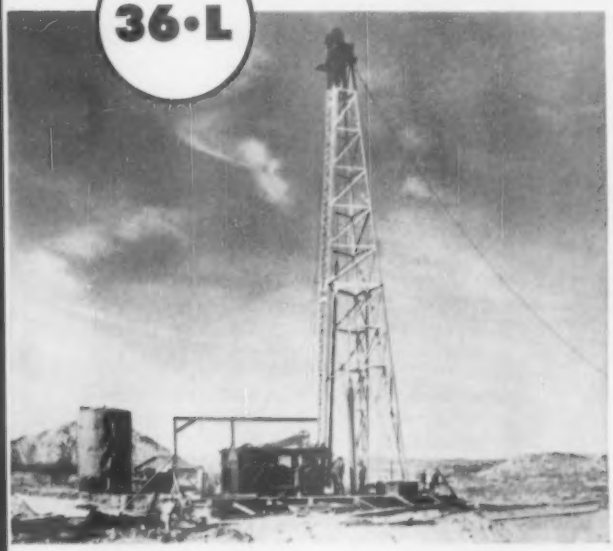
FIRST with the FINEST in SPUDDERS

MOST PREFERRED SPUDDERS

EACH MODEL FEATURES:

* FREE-WHEELING SAND REEL
* POWERFUL BULL REEL
* STRONG, TELESCOPING DERRICK
* SNAPPY SPUDDING ACTION
* FAST MOBILE MOUNTINGS
* QUALITY CONSTRUCTION

36-L

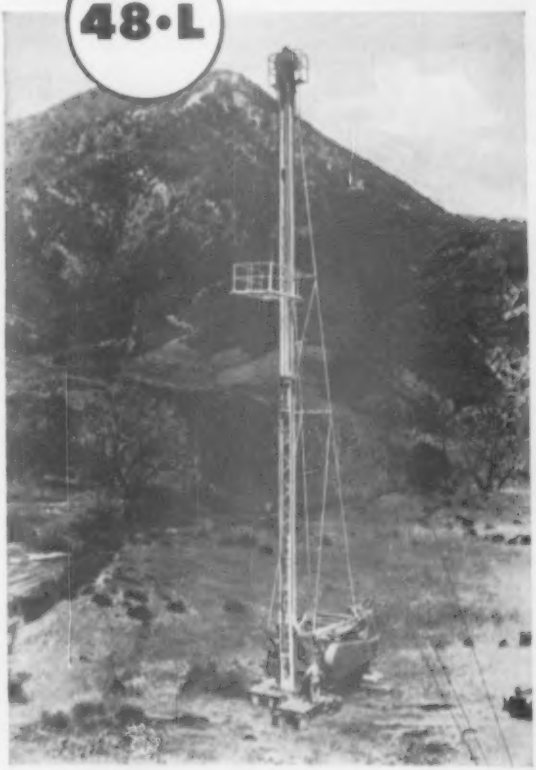


Top-to-bottom drilling to 3,500 feet; servicing to 4,000 feet; 5,000-lb. tool capacity.

ALL-'ROUND MONEY-MAKER . . .

"Mr. Spudder" in oil fields everywhere, the 36-L gives you a wide working range. It saves you time in handling tools, bailer, and casing on deep hole drilling. It's ideal over the whole range of workover operations. Its 54-ft. derrick handles casing loads to 120,000 lbs. with auxiliary A-frame; 70-ft. tripod derrick (shown above) permits handling casing loads up to 300,000 lbs. Bull reel can handle 32,500-lb. line pull in low gear; sand reel, 12,800 lbs.; calf reel, 22,000 lbs.

48-L



Top-to-bottom drilling to 6,000 feet; servicing to 7,000 feet; 6,700-lb. tool capacity.

DEEP-HOLE MASTER, BIG-TIME SERVICE . . .

If you specialize in deep hole drilling or servicing, or both, the 48-L with its 61-ft. derrick is your machine. Incorporating the speed and mobility of smaller rigs, this big, powerful rig handles casing loads to 120,000 lbs. with casing tackle strut and to 160,000 lbs. with auxiliary A-frame. It's also available with a 70-ft. tripod derrick which handles up to 300,000 lbs. A new, 85-ft. servicing derrick (shown above) is offered as special equipment. It handles up to 60,000 lbs. of tubing; has ample height to pull 30-ft. doubles.

BUCYRUS-ERIE CO.

South Milwaukee, Wisconsin

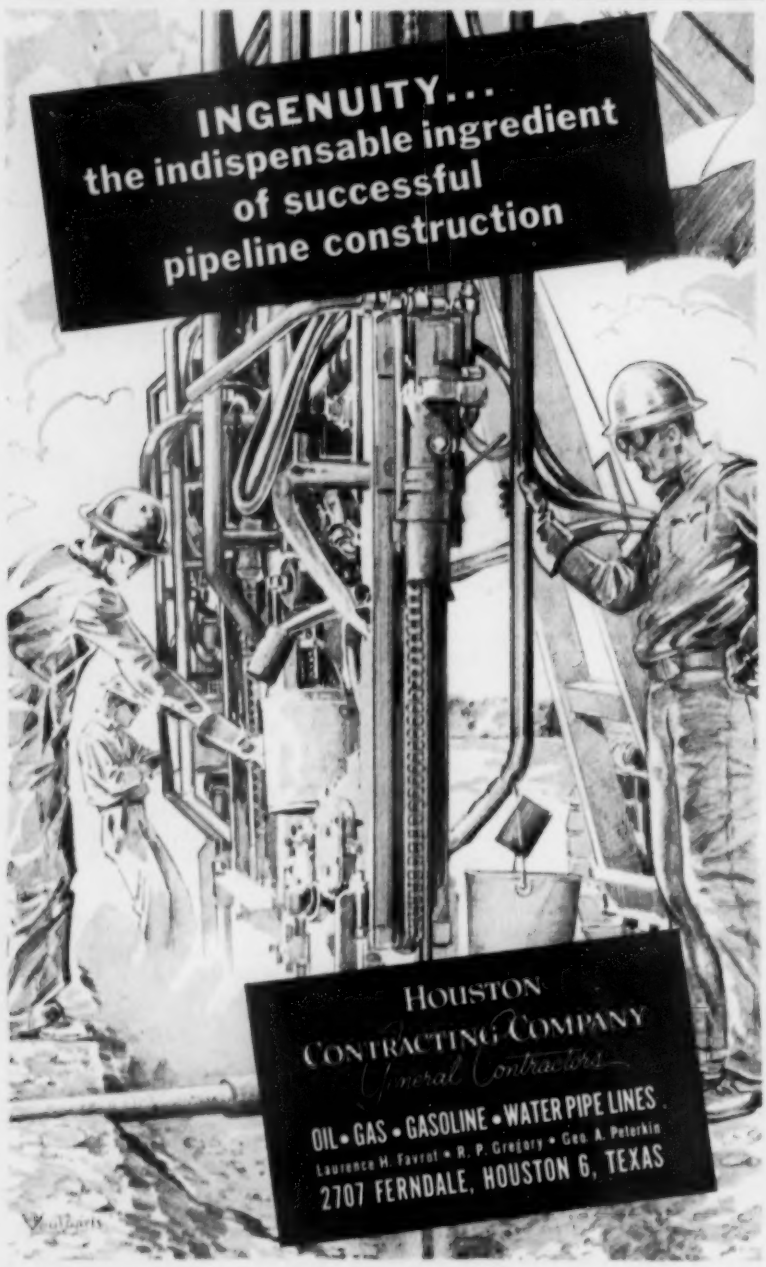
gineer. His experience with the company includes the fields of sales promotion and metallurgical engineering, both in Waterbury and at the Ohio mills.

Kremer started his sales work with the company in 1945. He spent 1 year at the Chase office in New York, and served as a salesman in the Indianapolis district until he was appointed district manager at Charlotte. Cox, who joined Chase in 1947, was made an outside resident salesman at Memphis in 1948 and continued in this position until his recent promotion to district managership of the Charlotte office.

Bendix Appoints Peters as Mobile Sales Engineer

The appointment of Jack E. Peters, mobile sales engineer, has been announced by A. E. Jones, mobile products sales manager, Bendix Radio Division of Bendix Aviation Corp. Peters will be responsible for sales and customer relations in connection with Bendix two-way radio communication systems in Ohio and western Pennsylvania.

Peters has been active in the radio and communication field for 20 years and since 1951 has been directly concerned with mobile radio as a communication specialist.



Iverson Supply Makes Field Organization Shifts

John Crichten, field representative, has been transferred from Odessa to Sherman, Tex., and H. G. Sledge has been promoted to field representative for the Odessa, Tex., store, according to an announcement by The Iverson Supply Co., Tulsa. Sledge was formerly floorman for the Odessa store.

Baker Oil Tools Announces Transfers, Appointments

C. C. TAYLOR

Baker Oil Tools, Inc., Central division headquarters, Houston, recently announced personnel transfers and new appointments in the Central division. C. C. Taylor, former district manager, West Texas district, with headquarters at Midland, Tex., has been appointed assistant manager, sales and service, Central division, with headquarters in Houston.

J. T. MITCHELL

B. MITCHELL

J. T. Mitchell, former assistant district manager, West Texas district, has been appointed district manager, West Texas district, with headquarters in Odessa, Tex.

B. Mitchell, former oil-field service engineer at Odessa, has been appointed branch manager at a new branch recently opened at McCamey, Tex.

K. E. HAWKINS

J. L. PADGETT

K. E. Hawkins, former branch manager, Oklahoma City, has been appointed district manager, Mid-Conti-

"Not only can Ford Engines take it—they dish it out, too!"

Here's rugged going—Ford power is right at home

"Our Ford Industrial Engines take a terrific beating in transit—and when operating, have to work under heavy, constant loads. Yet they come through every time—dish out the power we need, *when* we need it. That means 'money saved' in our business."

—Dowell Incorporated Engineers

Dowell, a leader in chemical services for the oil industry, has for years used Ford Industrial Engines to power their equipment. The Ford "223" you see above, for example, is powering Dowell's specially-designed 10,000 gallon paddle mixer—used on this job to transport and mix special Dowell fracturing fluids and well-treating chemicals. Treatments such as this one help add substantially to the nation's recoverable oil reserves. This is only one of the many field services Dowell offers to the oil industry—and only *one* of the many ways Ford Power can be profitably applied to industrial equipment.

There's a Ford Industrial Engine to meet nearly *every* power need. And only Ford offers the economy of modern Short Stroke design in a *full line* of overhead valve 4-, 6- and 8-cylinder gasoline engines. Short Stroke design cuts piston speed, shortens the piston stroke—reduces friction and wear. The result is more *usable* power, less fuel consumption. And, thanks to a combination of exclusive durability features such as free-turn intake and exhaust valves, rigid deep-block construction in *every* engine, Ford Industrial Engines have that extra stamina it takes to shrug off rugged daily pounding and stand up longer in heavy-duty industrial work.

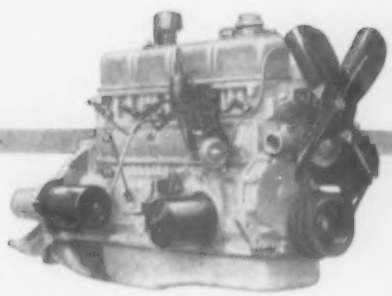
As headquarters to better serve users of industrial power, a network of newly-appointed Ford Industrial Engine Products Dealers has been set up across the nation . . . there's one in *your* area.

Write or phone today for complete information:

INDUSTRIAL ENGINE DEPT.

FORD Division of FORD MOTOR COMPANY

P. O. BOX 598, DEARBORN, MICH.



Ford "223"

FREE-TURN intake and exhaust valves help reduce valve sticking, maintain compression longer.

AUTOTHERMIC PISTONS with chromed top ring help maintain proper piston-to-wall clearance, prolong engine life.

FULL-FLOW OIL FILTER cleans every drop of engine oil every time around.

DEEP ENGINE BLOCK provides greater bearing support and unusually rigid attachment for bell housing, power take-off, or clutch and transmission.

Ford

INDUSTRIAL ENGINES AND POWER UNITS

nent district, with headquarters in Oklahoma City.

J. L. Padgett, former district staff engineer, Mid-Continent district, Oklahoma City, has been appointed branch manager of the Oklahoma City branch.

E. F. Hannon, Jr., former district manager, Mid-Continent district, has been appointed manager of the Houston export office, Central division headquarters, Houston.

J. C. Smith, Jr., former oil-field service engineer at Oklahoma City, has been appointed district staff engineer, Mid-Continent district with headquarters in Oklahoma City.

Schlumberger Moves Area Office to Billings, Mont.

Schlumberger Well Surveying Corp. has moved its northern Rocky Mountain division office from Casper, Wyo., to Billings, Mont. The division office is temporarily located in the Mobil Building, but after November 1 it will be permanently located in the Medical Arts Building.

The staff in the northern Rocky Mountain division office consists of J. L. Heath, division manager; W. W. Bilburn, staff assistant; C. R. Hazelbush, computer; and J. E. Skau, general field clerk. Schlumberger's Casper district office remains in Casper. Robert E. Jones is the district manager.

Lucey Products Establishes Facilities at Houston

CECIL HILLIARD

Lucey Products Corp. has reentered the Gulf Coast and Southwest Texas area and has established offices and service facilities on Almeda Road, Houston, according to an announcement by W. G. Rudd, vice president in charge of sales.

The corporation's affairs in the area are under the direction of Cecil Hilliard with Edward R. Ryan assisting.

Hilliard has been identified with the oil-industry equipment business more than 20 years. Until he joined Lucey he was Texas agent for Cardwell Manufacturing Co. and prior to that time was with Republic Supply Co. Ryan has been active in the supply industry over 15 years.

Reynolds Made Welex Jet's Shawnee Assistant Manager

Hadley A. Reynolds has been named assistant manager of the Shawnee, Okla., district for Welex Jet Services, Inc. He has been with Welex for 5½ years and has served as rigger, shooter and sales engineer prior to this promotion.

Sales Staff Changes Made By Continental Supply Co.

Continental Supply Co. has announced the appointment of two new store managers and a production-equipment specialist. John Bowley, former field salesman, will be store manager at the oil-field company's outlet at Drayton Valley, Alta., Canada. New store manager at Liberal, Kans., is L. Z. Bolding. H. W. Pringle will be a production-equipment specialist with headquarters in Great Bend, Kans.

Bowley joined the company in 1955. The Canadian division's headquarters are located in Calgary, Alta.

Bolding's previous positions included warehouseman and field salesman. He has been with Continental since 1951. Pringle has been a Continental employe since 1948. Former positions in-

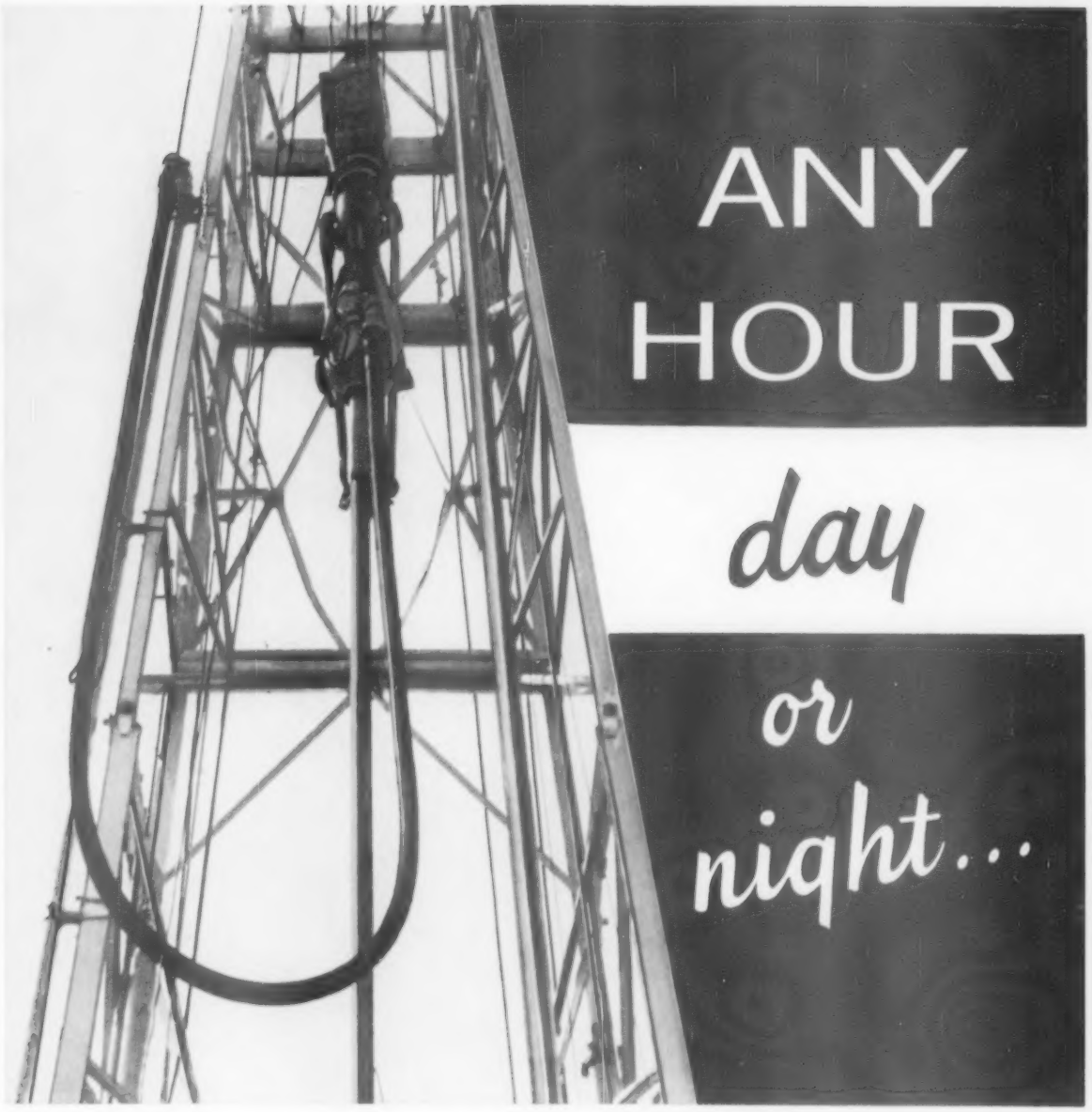
CORROSION CONTROL IS A YEAR-ROUND JOB

Chromates never take a vacation from their work in controlling corrosion. There is never a seasonal lay-off for these effective inhibitors. Summer, winter, fall and spring — chromates continue to be essential in efficiently protecting such equipment as cooling towers, evaporative condensers, air conditioning units, diesel engines, automobile radiators, boilers, pasteurizers, freezing plants, ice cans, and ammonia absorption systems.

But there is a way for you to take a vacation from your corrosion problems. Let Chromium Chemicals do the job. Mutual, a dependable source of supply for the highest quality Chromium Chemicals, will be glad to help you decide which is the best chromate to fit your requirements.

SODIUM BICHROMATE CHROMIC ACID SODIUM CHROMATE
POTASSIUM BICHROMATE POTASSIUM CHROMATE

MUTUAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
99 PARK AVENUE • NEW YORK 16, N. Y.



ANY HOUR *day* *or night...*

You can obtain
Republic Hose
from your J & L Store

Stocked in the
Mid-Continent Area by
JONES & LAUGHLIN
SUPPLY DIVISION
P.O. Drawer 2481, Tulsa 2, Okla.
and the J & L Store
in YOUR field

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS

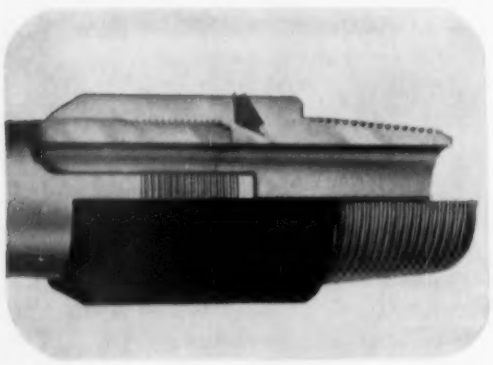
Stocked on the West Coast by
HENDRIE BELTING & RUBBER CO.
405 Towne Ave., Los Angeles, Calif.
PACIFIC COAST RUBBER COMPANY
51 Main St., San Francisco, Calif.

. . . right at the

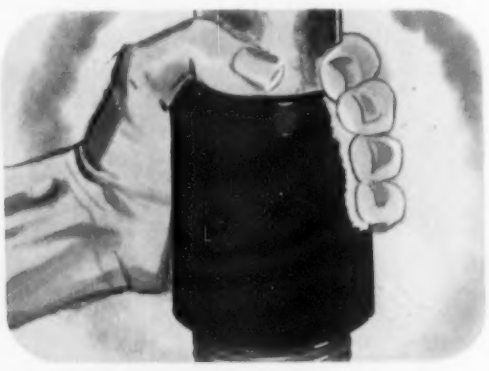
Take a look at the tool joint that's right for your rig

1. **Cut Your Drill String Inventory In Half** – Tool joints account for about 50% of the cost of your drill pipe equipped with tool joints. You can save working capital by stocking only the pipe—then buying tool joints only as needed.

2. **Cut Down On Shop Work, Transportation, Expense, Delays.** Reed Super Shrink-Grip tool joints are field-replaceable, allowing all changes in your drill string to be made *right at the rig!*



4. **Fixed Landing Shoulder** assures proper makeup, eliminates guesswork, effects an extra seal. Reed's men or your own simply screw heated joint onto drill pipe until landing shoulder "goes home" with a jar.



5. **Unitized, Leak-Proof Bond** between tool joint and drill pipe is assured by Super Shrink-Grip feature. As heated tool joint cools, it "shrinks" a predetermined amount, bringing tool joint and pipe surfaces together in a "super grip".

Naturally,

we're talking about the . . .

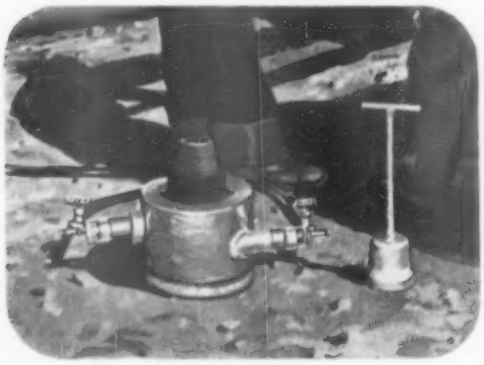
REED

Super Shrink-Grip

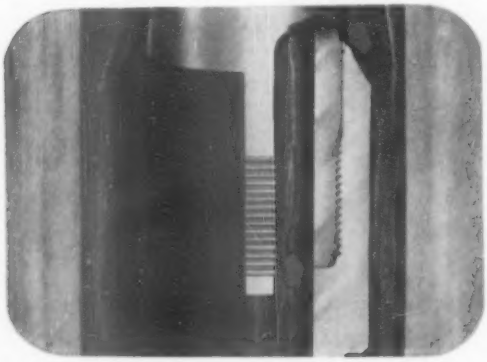
REED ROLLER BIT COMPANY • HOUSTON 1, TEXAS . . . Gulf Coast, Mid-Continent, Rocky Mountain and

rig !

regardless of its location



3. **A Telephone Call** brings the Reed instructor or crew with special portable equipment which permits easy, undamaged application or removal of tool joints *right at the rig!*



6. **Perfect Sealing Of Thread Areas** is the result of exceptional care in machining thread and Shrink-Grip areas, plus Reed's 120 inspections during the manufacturing process.

TOOL JOINT!

Canadian Distributor for Martin-Decker Products

1 in 1940

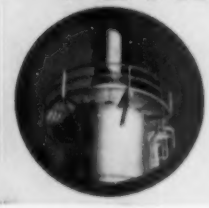
today... **1425**

in operation

and **75** more under construction

a record of installations that is incomparable
just as all Petrochem-Isoflow Furnaces
are more economically desirable by any comparison.

PETROCHEM-ISOFLOW FURNACES



UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42nd St., New York 17, N. Y.

REPRESENTATIVES:

Rawson & Co., *Houston* • Wm. H. Mason Co., *Tulsa* • Lester Oberholtz, *Los Angeles* • Pavillo-Levally, *Chicago* • D. D. Foster, *Pittsburgh* • Turbex, *Philadelphia* • Flagg, Brackett & Durgin, *Boston* • G. M. Wallace & Co., *Denver & Salt Lake City*

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clude warehouseman, bookkeeper, assistant store manager and field salesman.

Security Engineering Makes Changes in Sales Staff

MACK HARLAN

Promotions for two employes and three appointments have been announced by A. M. Birnie, vice president in charge of sales, Security Engineering Division, one of the Dresser Industries.

Mack Harlan, formerly salesman, has been named district manager at Colorado City, Tex. Joe Holley, formerly field serviceman at Odessa, Tex., has been named salesman with offices at Colorado City.

Don Jackson and Sam Gullett have been appointed as salesmen, and Daniel A. Chauvin has joined Security as field serviceman. Jackson will service the Panhandle sections of Texas and Oklahoma from headquarters in Pampa, Tex. Gullett and Chauvin will both work out of the Houma, La., offices.

Schlotterbeck Heads New Reliance District Office

William K. Schlotterbeck has been appointed district manager of Reliance Electric & Engineering Co.'s newly established district office in Dallas, it has been announced by C. V. Gregory, manager of district sales at the company's headquarters in Cleveland, Ohio.

Schlotterbeck, district manager in Buffalo, N. Y., since 1954, has been with Reliance 17 years.

In the Dallas district the company also has a sales office at Little Rock, Ark., managed by Ernest R. Wesley, who reports to Schlotterbeck.

Universal Organizes Petrochemical Department

David W. Harris, chairman of the board of Universal Oil Products Co., has announced the formation of a new department which will be responsible for the commercial application of petrochemical processes licensed by the company.

This new department will be under the over-all direction of M. D. Gilchrist, process sales vice president, with H. W. Grote directing the group's activities. Grote was formerly assistant manager of the research and development laboratories.

E. R. Kanhofer, formerly manager

For High Speeds
...this new
dynamically balanced
Waldron
COUPLING

An entirely new design . . . built of specially selected material . . . thoroughly tested for proper balance. Truly a precision made coupling in every respect, accurately machined to close tolerances. If yours is a high speed application, write for our descriptive Bulletin No. 52.

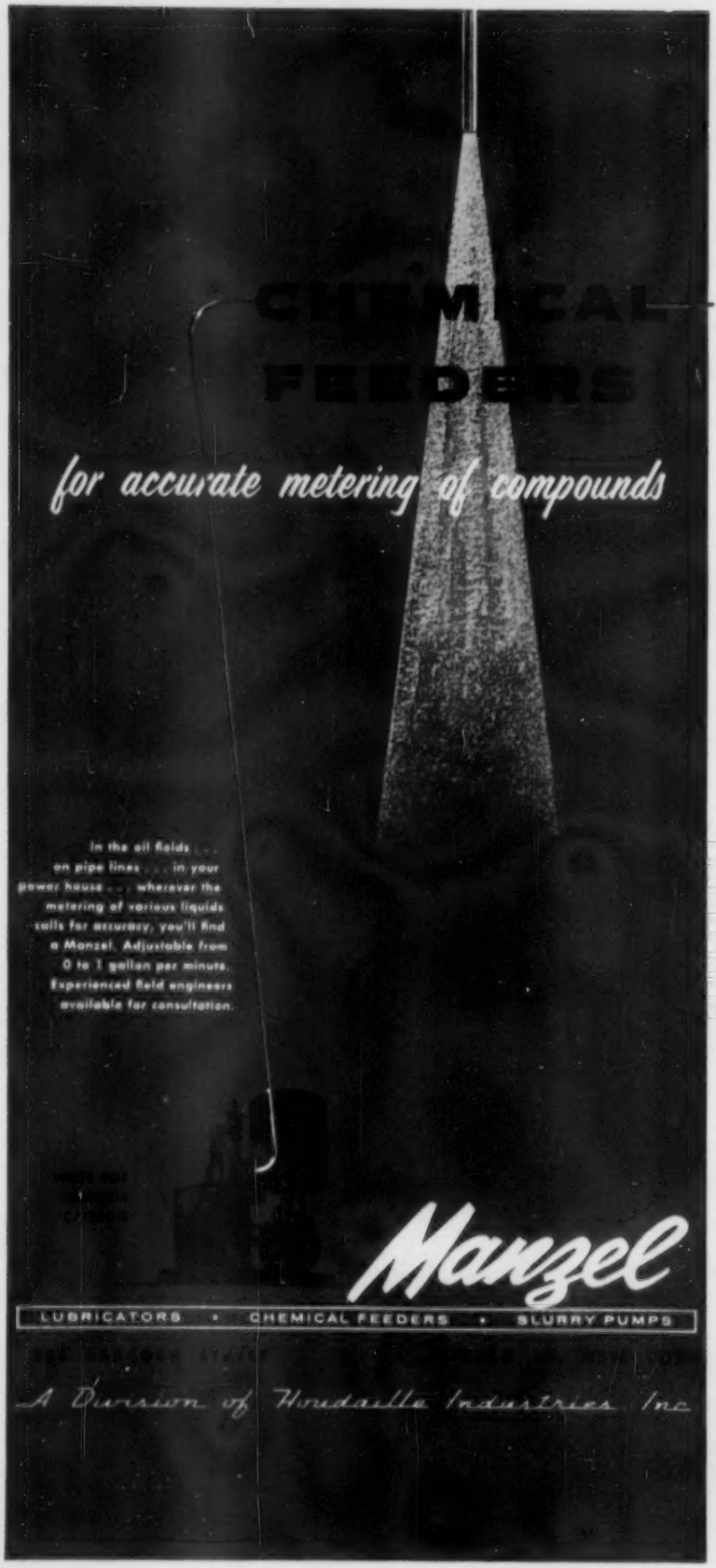
JOHN WALDRON CORP. • NEW BRUNSWICK, N. J.

Sales representative in Principal Cities

STANDARD TYPES

Waldron
COUPLINGS

SPECIAL TYPES


CHEMICAL
FEEDERS
for accurate metering of compounds
In the oil fields . . . on pipe lines . . . in your power house . . . wherever the metering of various liquids calls for accuracy, you'll find a Manzel. Adjustable from 0 to 1 gallon per minute. Experienced field engineers available for consultation.
Manzel
LUBRICATORS • CHEMICAL FEEDERS • SLURRY PUMPS
A Division of Houdaille Industries Inc

of Universal's facilities at Riverside, Ill., has been named assistant to Col. J. C. Raaen, vice president in charge of research.

Cameron Names Hager To Top Canadian Post

The appointment of R. E. Hager of Houston as manager of Cameron Iron Works of Canada, Ltd., has been announced by John Grubb, manager of Cameron's international division.

Hager's headquarters will be in Edmonton where Cameron maintains complete warehousing, assembling and testing facilities. Offices also are maintained in Calgary.

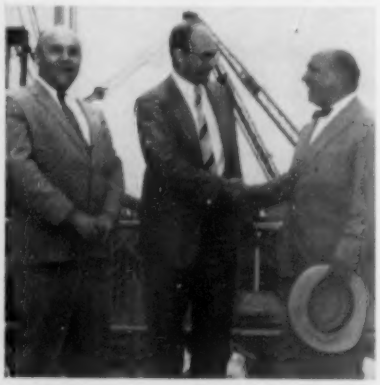
Forging sales engineer before his new appointment, Hager has been with Cameron 13 years. Prior to joining Cameron, Hager was a field engineer with National Standard Oil Co. and also associated with McEvoy Co. as a tool engineer.

Drilling Tender, "Joseph Zeppa", Commissioned

The drilling tender, "Joseph Zeppa," has been placed in commission by the owner, Delta Marine Drilling Co., following a christening ceremony at American Marine Corp. (formerly Alexander Shipyard).

A converted LST, the tender is a nonself-propelled vessel, 328 ft. by 50 ft. by 28 ft., and was reconstructed, equipped and outfitted in strict accordance with the requirements of the American Bureau of Shipping, the U. S. Coast Guard, and the Public Health Service for drilling in the gulf.

The principal feature of the tender is that all light and power is supplied to the tender and the drilling platform by an a.c. electrical system. On the tender itself are installed the main power plant, the main mud pumps, active and reserve mud pits, all drilling

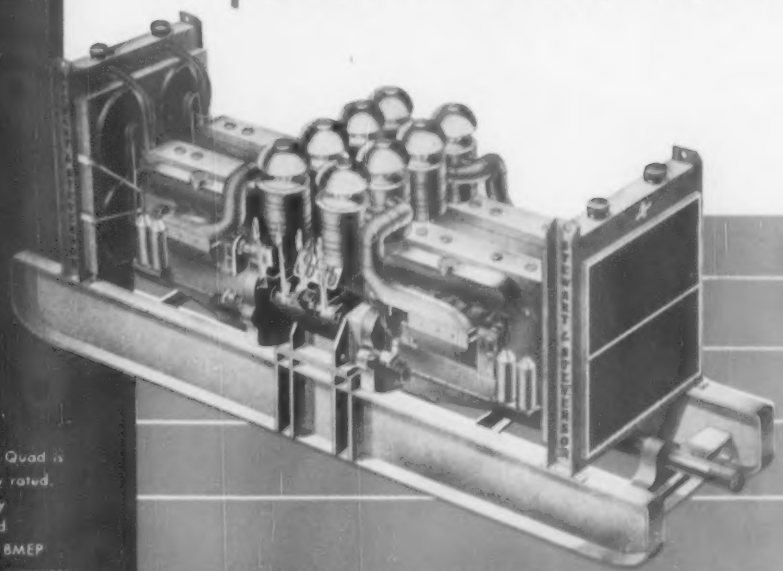


Chris Zeppa, vice president of Delta Marine Drilling Corp.; Leslie B. Durant, president of American Marine Corp.; and Joseph Zeppa, president of Delta Marine Drilling Corp.

STEWART & STEVENSON...FIRST TO PRESENT A NEW MODEL 6-110 GENERAL MOTORS QUAD APPLICATION

It packs a 1000 H.P. WALLOP!

6-110 QUAD



55% MORE POWER

- Hydraulic actuated disconnect clutches. Power may be taken off either end of the 6-110 Quad. A dual power takeoff arrangement is also available.
- Reduced fuel consumption. The New 6-110 Quad delivers more horsepower per fuel dollar than previous units.
- The 6-110 Quad is conservatively rated. It is naturally aspirated and consequently BMEP and cylinder pressures are low.
- Standard General Motors Diesel Parts in both the gear and engine applications.
- Adapted, developed and guaranteed by Stewart & Stevenson, The Nation's Largest Distributor of Diesel Engines.

This new GM 6-110 Quad, adapted and developed by Stewart & Stevenson, brings to the oil industry a new concept of a compact, high horsepower package at reasonable cost. The new 6-110 Quad develops 880 to 1000 continuous horsepower, or up to 1200 intermittent H.P. It is the largest horsepower engine in its class. It develops more usable horsepower at speeds that are acceptable in more oil field applications than any other engine.

Several years ago, Stewart & Stevenson introduced the Series 6-71 Quad to the oil industry. No other engine unit has ever matched it for service. Now, here is a new, higher horsepower 6-110 Quad with the same characteristics for dependability and performance of the earlier model, yet with 55% more horsepower.

The new GM 6-110 Quad by Stewart & Stevenson utilizes approximately 98% standard GM Diesel Engine parts in both the gear and engine applications. It uses tandem twin gear parts in a newly designed and ruggedly built case of welded steel construction, designed especially for the 6-110 Quad application.

The New 6-110 Quad is very compact, and, in most instances, will fit into the same space as the earlier Quad 6-71. This new 6-110 Quad has the lowest unit cost of any diesel engine power arrangement with comparable horsepower.

Please write, phone or call your nearest Stewart & Stevenson Representative or Branch for complete details.

STEWART & STEVENSON

STEWART & STEVENSON SERVICES, Inc.

Main Office and Plant: 4516 Harrisburg Blvd., Houston 11, Texas. Phone CApitol 5-5341.
Branches: Corpus Christi, Dallas, Lubbock, San Juan, Odessa
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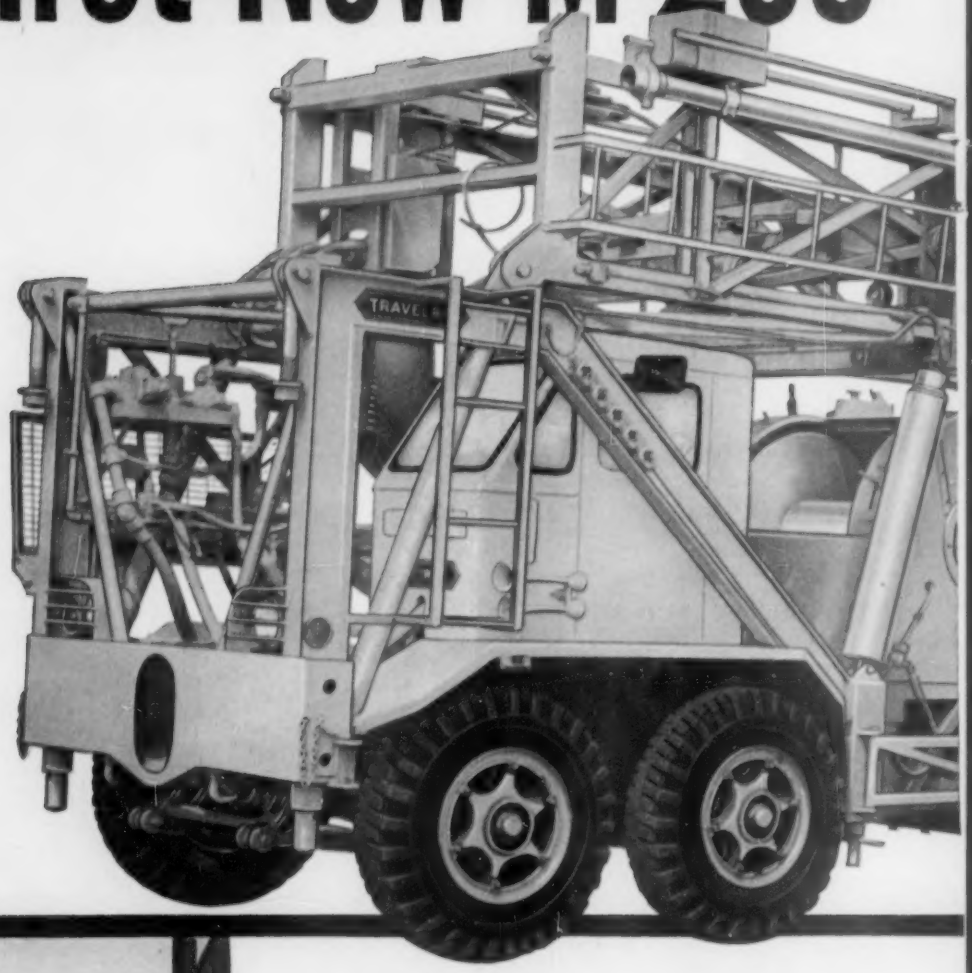
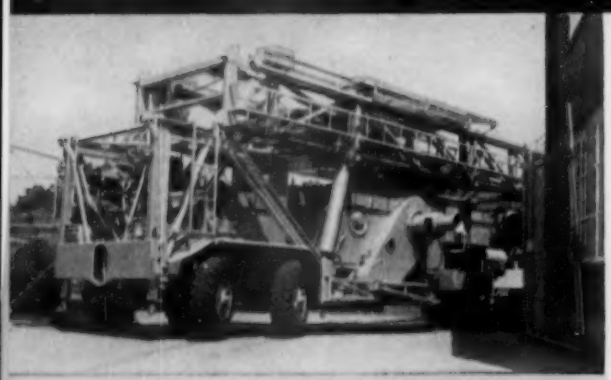
THE NATION'S LARGEST DISTRIBUTORS OF DIESEL ENGINES

BIG things are happening at **cardwell...**

The First New M-250





SHORT TURNING RADIUS

Extremely maneuverable and highly mobile... road speeds of 30 to 40 MPH... All combine for the utmost in speed and efficiency.

1. **DRIVE-IN UNIT**—a variety of power units can be supplied with torque converters plus an Allison Torqmatic Transmission to power the vehicle and/or draw works.
2. **HEAVY DUTY MAST**—is a 4-leg structural type, 96' high, guyless, 150,000 lb. hook load with hydraulic power for raising and extending the mast.
3. **HIGH CAPACITY HYDRAULIC PUMP**—provides power to operate blowout preventer, shale-shaker, power tongs and wash-down pump as standard equipment. An optional pump to operate a hydraulic rotary table is available.
4. **POWER UNITS**—Cardwell offers a choice of engines and horsepower ratings.
5. **ROTARY TABLE DRIVE**—optional—hydraulic or mechanical drives are available.
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3rd EDITION! 225 pages covering economic and equipment considerations. Comprehensive and complete. Free to contractors and oil company executives. Write Philip L. McLaughlin, Director Drilling Research, Cardwell Manufacturing Co., on your company letterhead.

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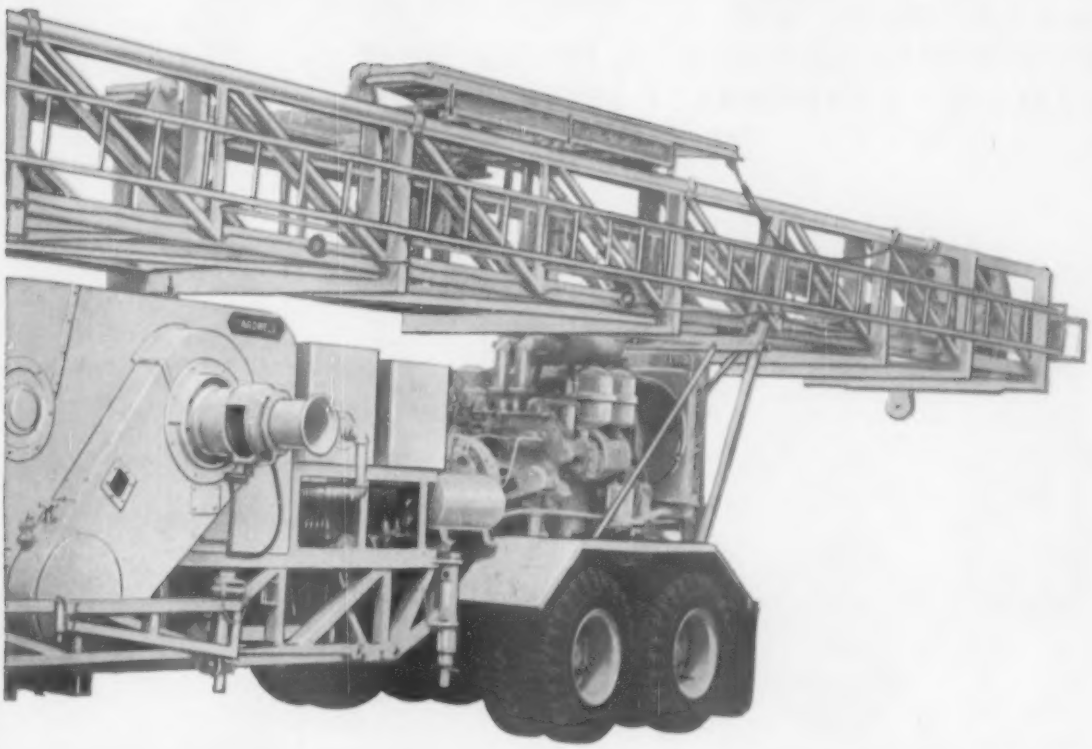

A SELF-PROPELLED SERVICING . . . WORKOVER . . . OR DEEP SLIMHOLE RIG

A truly versatile heavy-duty self-propelled drive-in rig that can "turn on a dime." Servicing and workover to 13,000-feet, pulling 2½" tubing. Handles 4½" drill pipe to 4,000-feet or slimhole pipe to 6,500-feet.

New light alloy steels make it tougher . . . but lighter. Width and height within legal limits. Easily accessible clutches mounted outside of main frame, oversized brakes and drums for 3 wrap spooling with splash-water cooled brake flanges plus many other new features, make the new Cardwell M-250 the latest in utility and performance . . . It's the first of many new things coming from Cardwell.

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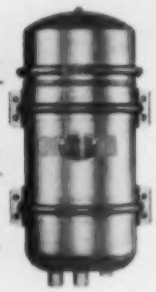
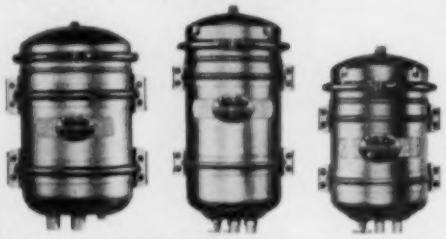
FOR EVERY TYPE OF ENGINE EVERY TYPE OF OIL

STANDARD and OPTIONAL EQUIPMENT ON LEADING DIESEL TRUCKS TRACTORS & STATIONARY ENGINES

Only a Luber-finer Filter Unit with a genuine Luber-finer Pack produces the patented filtering process that gives engineered protection to engine and oil as recommended by equipment manufacturers. The vital oil supply is circulated through Luber-finer's exclusive specially processed media which removes not only the injurious suspended solids from the oil but also the colloidal impurities which are often more damaging, thus increasing the life of both engine and oil. *The Efficiency of Luber-Finer's Patented Process has never been equalled!*

The Luber-finer patented filtering process returns the oil to the engine with the excellent lubricating qualities as specified by the manufacturers of today's modern high powered engines, resulting in the addition of thousands of miles to engine and oil life. Every minute—every mile your engine is run it must be protected. There's a Luber-finer model especially designed for your type of engine or oil.





DON'T BE MISLED! ONLY GENUINE LUBER-FINER PACKS GIVE EXCLUSIVE ENGINEERED PROTECTION

DIESELPAK — Designed for use with H.D. detergent compounded oils. May also be used with fuel oils and straight mineral oil. Removes impurities and contaminants—without affecting the additives.

REFINING PACK—Designed for use with straight mineral oils, fuel oils, hydraulic oils and inhibited industrial oils.

The Refining Pack, which combines ABsorbent with ADsorbent filtration, removes acids, moisture, suspended particles and colloidal impurities during its effective life more efficiently than any other filter.

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fluids, evaporator unit, Halliburton unit, bulk, mud, cement, and chemical storage.

In rig-up operation, the tender-deck area is adequate to accommodate all of the platform drilling equipment. The 30-ton stiffleg derrick is of ample capacity to handle all platform items, eliminating the necessity of employing the services of a derrick barge in either rigging-up or rigging-down.

Dresser Manufacturing Plans Wellsboro Plant

Dresser Manufacturing Division, Bradford, Pa., one of the Dresser Industries, plans the construction of a new million-dollar plant in Wellsboro, Pa. The new plant will contain some 100,000 sq. ft. of manufacturing space and will employ between 200 and 300 persons. Scheduled for completion in early 1957, it will be used for manufacturing compression fittings.

BJ Tools Appoints Personnel in Texas

V. C. Horner, vice president and manager of sales for Byron Jackson Tools, Inc., has announced four new personnel appointments. All four men will be stationed in Texas and are under the direction of R. J. Evans, Mid-Continent regional sales manager.

John P. Kirby has been appointed district manager for the North Texas area, which includes Fort Worth and Dallas. I. B. Bryan has taken over the duties of district manager for the West Texas-New Mexico area. Morris (Jack) Van Valkenburg and W. Kent Gafford have been assigned to sales duties in Odessa.

Twin Disc Clutch Honors Chairman and Co-Founder

P. H. Batten, chairman and co-founder of Twin Disc Clutch Co., was guest of honor at a luncheon and plant ceremonies held in Racine, Wis., recently.

Governor Walter J. Kohler of Wisconsin was the principal speaker at a dedication program honoring Batten's thirty-eighth anniversary with the company, and also the construction of a new building being erected at Racine to house the company's expansion program. The first unit of the new construction will give the company an additional 100,000 sq. ft. of plant space.

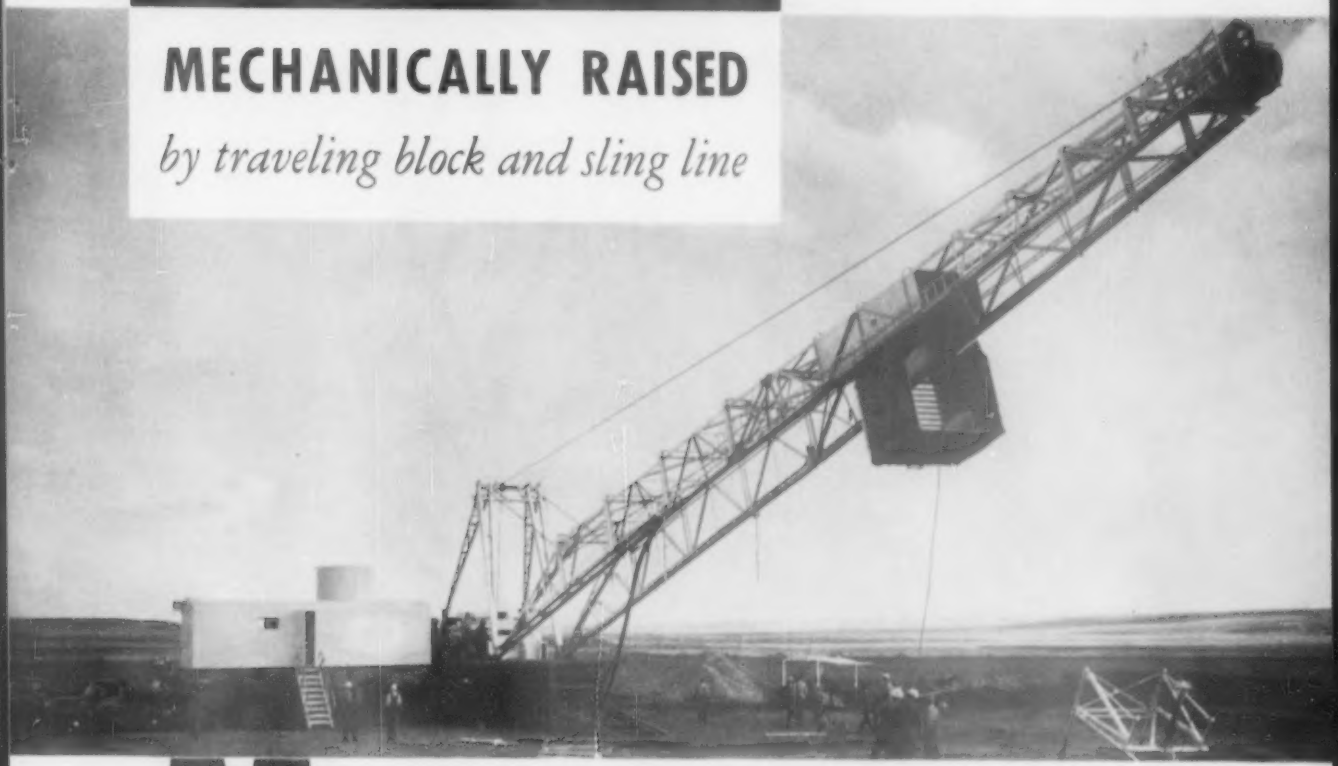
Guests visited the present plant and headquarterers of the company and many also visited the Rockford, Ill., plant which has been in operation for several years. John H. Batten, president of the company and son of the

LEE C. MOORE

trailer mounted masts

MECHANICALLY RAISED

by traveling block and sling line



LEE C.

Moore

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FOREIGN LICENSED MFR. OIL WELL ENGINEERING CO., LTD., CHEADLE HEATH, STOCKPORT, ENGLAND

Lee C. Moore trailer mounted masts are extended full length in horizontal position. Then, utilizing drawworks power, they are mechanically raised to drilling position by traveling block and sling line. The entire operation is always safe . . . simple . . . fast . . . dependable

- **SINGLE TRAILER MOUNTED MASTS**
  86 ft 94 ft. 97 ft. 97 ft. Heavy duty
  100 ft. 126 ft. Export Model

- **DUAL TRAILER MOUNTED MAST**
  97 ft. 100 ft. 126 ft. 126 ft. Export Model

WE TIED A KNOT IN THE "TIGER TAIL"

so it won't slip through your glove. You'll never know what "spinning" really means until you grab hold of that Tiger Tail. Proof-tested links "spin 'er up fast" and they last and last for more round trips. Try it yourself—pick up a genuine Web Wilson TIGER TAIL Spinning Chain, in the yellow and black box, at your supply store.

WEB WILSON

LOS ANGELES • DALLAS • NEW YORK

Oil Tools INC FIELD PROVEN

co-founder; M. F. Adamson, vice president in charge of sales; W. B. Gibson, sales manager of the hydraulic division; and Jack C. Yetter, sales manager of the general products division, were among the officials of Twin Disc Clutch Co. who served as hosts.

Hughes Named Division Manager for Medearis

John B. Hughes has been appointed San Joaquin division manager of Medearis Oilwell Supply Corp. Hughes serviced this area for the Medearis organization for 10 years prior to 1952. In 1952 he went in business for himself in South Dakota as a manufacturers agent.

Bethlehem Promotes N. G. Nelson and V. V. Dick

N. G. Nelson and V. V. Dick have been promoted to the position of store manager and field representative and transferred to Alice, Tex., and El Dorado, Kans., respectively. Nelson was formerly field representative at Corpus Christi, Tex., and Dick held the same position at Medicine Lodge, Kans.

Perforating Guns Atlas Celebrates Anniversary

On October 15 Paul Charrin, president, and J. H. Castel, executive vice president, of Perforating Guns Atlas Corp., will celebrate the tenth anniversary of the founding of their company.

The business was started with one employe, in quarters covering only 500 sq. ft. Two plants in Houston now occupy over 40,000 sq. ft. of floor space. Forty offices and stations and a staff of over 600 technicians now serve the oil industry.

PGAC serves the oil fields in this country, and through three subsidiary companies serves Canada, Venezuela, and Germany. Oil-well perforating and electrical and radiation logging, are the primary services offered. Other services include: microcaliper surveys, photoclinometer surveys, sidewall sample coring, temperature-collar logging, various types of logging and perforating through tubing, and wireline auxiliary services for well completions.

Departmental executives joining with Charrin, Castel, and PGAC's employes in celebrating the company's tenth anniversary will include: W. R. Rabson, manager of radiation logging labora-

Faster metal cleaning

HIGH speed Osborn power brushes quickly and thoroughly remove even the heaviest deposits of rust, scale, dirt and incrustations from metal surfaces. They simplify the preparation of pipe ends for welding . . . speed up the finishing of welded joints.

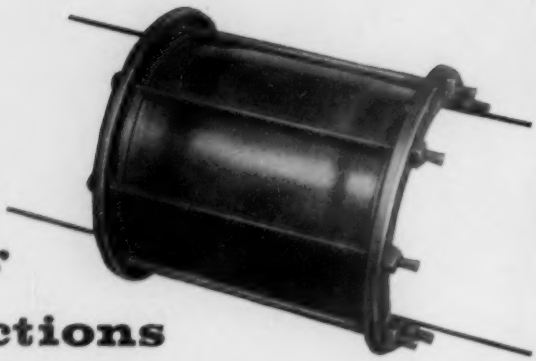
These are but a few of the many metal cleaning problems that the oil and gas industry is solving with Osborn power brushing methods.

For information on Osborn's complete line of top-quality industrial brushes, write for Catalog 210-B. *The Osborn Manufacturing Company, Dept. N-14, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

COMPLETE TOP-QUALITY LINE
Osborn has a brush to meet every industrial need—power, paint or maintenance . . . and you get quality automatically when you specify "Osborn".

Osborn Brushes

OSBORN BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES



for
safer
connections
join pipe

THE DRESSER WAY!

You'll find many piping jobs in and around oil terminals and refineries that can be simplified and speeded up with Dresser Couplings and Long Sleeves.

Particularly advantageous for tank and equipment installations, Dresser Couplings have a special "built-in" give and take that absorbs vibration, settlement and other stresses.

Perfect alignment of piping is unnecessary because a specially compounded rubber gasket permits up to 4° deflection at joints while guaranteeing bottle-tight connections.

Only a wrench is needed to make the connection. Threading is not required. Any workman can install Dresser Couplings, averaging two man-minutes per bolt.

AVAILABLE AT ALL LEADING OILFIELD SUPPLY STORES IN THE UNITED STATES AND CANADA

DRESSER®

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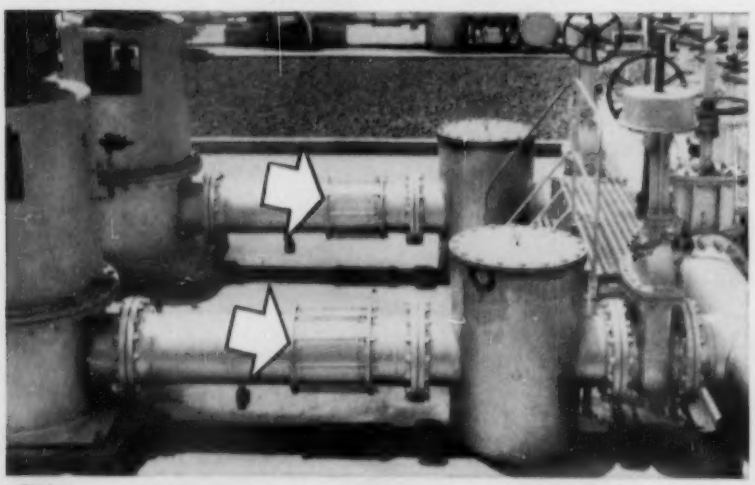
Dresser 10" Style 40 Long Sleeves on pump at oil terminal



Style 38 Coupling

Style 40 Long Sleeve

Hydrepair® Asbestos Cement Pipe Clamp

Style 63 Expansion Joint

Style 39 Insulating Coupling

tories; James H. Russell, manager of operations; Jake H. LeBus, manager of engineering; William L. Young, sales manager; T. H. Winkler, purchasing agent; Cecil C. Hinson, assistant to the president; and H. Clay Waters, manager of electrical logging.

Lane-Wells Opens New Branch at Roundup, Mont.

To serve the increasing needs of the fields in Musselshell County, Montana, Lane-Wells Co. has opened a new branch in Roundup, Mont., it has been announced by George Long, Williston district superintendent.

This location was selected as the strategic center for the quickest service to all parts of the area. The new branch is fully equipped to provide perforating service and well-logging service on the usual 24-hour-a-day basis. It is under the direction of Robert L. Westall, veteran in oil-field service. Leonard L. Berce comes with Westall to staff the new branch.

Fisher Governor Appoints Eastern Representatives

Fred Crabbe and Jerry Stebbins have been appointed sales representatives for New York and the surrounding territory by Fisher Governor Co., Marshalltown, Iowa. Their organization will be known as Crabbe & Stebbins Co., with offices located in Englewood Cliffs, N. J., and Albany, N. Y.

Lynn Maxwell and William Conway have also joined Crabbe & Stebbins. Maxwell, who has 2 years' sales experience with Fisher, will devote his attention to gas-distribution equipment. He will work out of the New Jersey office. Conway has been with Fisher since 1953 and will head the Albany office.

Crabbe joined the Fisher sales organization in 1943 and has been in New York since 1945. Stebbins entered the New York sales office in 1947.

Acid Engineers Expands Personnel and Operations

Ralph (Warky) Warkentin has been employed as assistant general manager at Lakin, Kans., for Acid Engineers, Inc.; C. H. Michael has been stationed in Liberal, Kans., as sales engineer; and Norman (Cotton) Johnson has been promoted to district sales engineer at Lakin.

At Great Bend, Kans., Harry Ochs has been named station manager and treating engineer; Bob Villines is sales engineer; Dale Spruill has been employed to assist in sales and treating; and Jimmie Strunk has been transferred

B and W SCRATCHERS and CENTRALIZERS

B and W Multi-Flex Scratcher

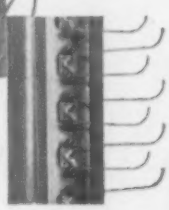
B and W Hinged Nu-Coil Scratcher

B and W Latch-on Centralizer with Kon-Kave Bow

B and W Latch-on Stabilizer Plain Type

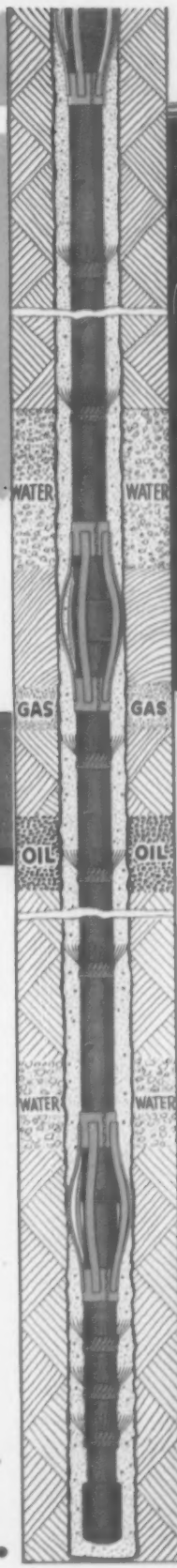
Multi-Flex Type

B and W Rotating Scratchers



Nu-Coil Type

First in the Field...



For a Good Cement Job

B and W originated and pioneered the LATCH-ON-CENTRALIZER for easy installation . . . the KON-KAVE Bow for greater centering strength . . . the WALL CLEANING GUIDE . . . the MULTI-FLEX and HINGED NU-COIL SCRATCHERS FOR POSITIVE MUD REMOVAL and COMPLETE CEMENT FILL.

In the drilling of oil wells, mud cakes are formed on the permeable formations. Cement slurry will only bond with the formations when the mud cakes have been "scratched off" the wall of the hole.

B and W Incorporated

Well Completion Specialists

GULF COAST	WEST COAST
Box 5266	Box 3751
Houston 12, Texas	Los Angeles 54, Calif.
Phone WAlnut 3-6603	Phone DAvis 4-1106

to Great Bend as treating-engineer trainee.

D. J. (Don) Roepe, formerly at the Great Bend station, has been installed as treating engineer at the Elkhart, Kans., station.

The Plaineville, Kans., area will continue to be served by James L. Strunk as district sales engineer and by D. B. Strunk as station manager.

Acid Engineers, with general offices in Lakin, has purchased four larger, high-pressure, fracturing units within the past 6 months to enable the company to offer more complete acidizing services and acid-frac services as well as the oil-sand fracturing service.

Reed, Taylor Advanced in Dowell's Research Dept.

James E. Reed has been promoted in Dowell's research and development department, becoming assistant to the manager, according to an announcement made recently by Dr. W. W. Love, Dowell director of research. At the same time, Love reported the advancement of Lloyd C. Taylor to the position of group leader in the research and development department.

Reed joined Dowell at Midland, Mich., in 1939 as paymaster in the company's executive offices. He joined Dowell's research department at Tulsa in 1949 after service in the Air Corps. In 1953 he was given added responsibilities and the title of development engineer.

Taylor has been located in Dowell's general offices in Tulsa as development engineer since early this year. He joined Dowell as a service engineer at Salem, Ill., in 1954 following several years with Atlantic Refining Co. as production foreman and drilling engineer.

Dayton Heads Berkeley's Marketing Program

Michael S. Dayton has joined the Berkeley division of Beckham Instruments, Inc., as assistant marketing manager, it has been announced by Division Manager Thomas Allinson. Formerly sales manager for Beckman's Arga division, Dayton will take charge of the Berkeley marketing program.

Dayton was employed by Sperry Gyroscope Co. and Lear, Inc., before affiliating with the Beckman organization.

Royston Appoints Brown As Regional Manager

Linn P. Brown, Jr., has been appointed regional manager for Royston Laboratories, Inc., Pittsburgh, manufacturers of Roskote cold-applied pipe mastics, anticorrosion products and industrial coatings. His territory includes the New England and Middle Atlantic area, with an office located at Philadelphia.

New Plant Acquired by Tube Turns of Canada

A plant at Ridgetown, Ont., has been bought by Tube Turns of Canada, Ltd., manufacturers of welding fittings and flanges for industrial piping systems. Production facilities have been moved from nearby Chatham, the company's former headquarters.

Twelve distributors and 15 branch outlets stock Tube Turns products. The company has two regional offices, one at Toronto headed by A. H. Brodie, district manager, and the other at Edmonton under the direction of H. E. Boynton, district manager.

Tube Turns of Canada, Ltd., is associated with Tube Turns, Louisville, Ky.

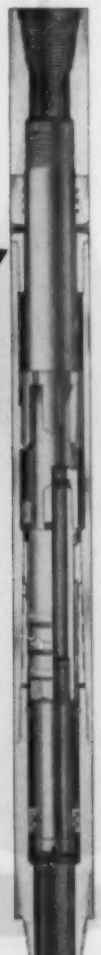
BOWEN *presents a tremendous advancement in Rotary Jar construction*

SEALED LUBRICATION
— practically eliminates wear
— greatly reduces servicing
— assures constant tripping tonnage

NOTHING PROTECTS METAL SURFACES LIKE AN OIL BATH

The tripping mechanisms in Sealed Type "I" BOWEN ROTARY JARS are identical with those in the earlier types of Bowen Jars that have performed successfully the world over under all types of conditions for many years. These new Jars differ in that they are filled with oil and sealed top and bottom against the ingress of well fluid. With this arrangement, the moving parts of SEALED TYPE "I" BOWEN ROTARY JARS work in a bath of oil.

SEALED TYPE "I" BOWEN ROTARY JARS are installed in fishing strings to enable the operator to strike heavy upward blows against an obstinate fish and knock it loose. They are also installed as safety devices in strings during testing, coring, reaming, drilling, side tracking and washing-over operations. Their presence insures the operator of the ability to knock the string loose should it stick.



Outstanding Advantages

SEALED TYPE "I" BOWEN ROTARY JARS are straight pull mechanical type Rotary Jars which provide greater efficiency in operations. They:
— Prevent accidental release of the fishing tools below the Jar
— Operate successfully under all conditions
— Deliver the same heavy upward blow regardless of the rate at which the string is elevated
— Feature oversize circulation holes which permit use of wireline tools and allow passage of large fluid volumes

Sealed Type "I" Bowen Rotary Jars

Write for descriptive literature

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Controlled Fissuring Power!

Welex BEAR GUN

(FORMATION FRACTURING TOOL)

The gun that shoots 'round a corner!

Welex called this mighty innovation the Formation Fracturing Tool when they developed and introduced it two years ago — you, in the field, gave it a new name after using it — the Bear Gun. By any name — oil operators everywhere are calling more and more for the tool's great fissuring power in their tough wells. Wherever the formation or a heavy invasion of mud or cement hinder the flow, call Welex for the Bear Gun. Each shot will give you a large entrance hole — deep into the formation — and the extensive fissuring that reduces pressures and makes your fracturing job a success!

Perforating is no sideline with WELEX!

ORIGINATORS OF JET PERFORATING — Welex

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SALES OFFICES: Dallas, Wichita

DISTRICT OFFICES: Abilene, Ardmore, Beaumont, Corpus Christi, Falfurrias, Farmington, Fort Morgan, Great Bend, Hobbs, Houma, Houston, Lafayette, Lake Charles, Liberal, Odessa, Pampa, Pauls Valley, Pawhuska, Plainville, San Angelo, Shawnee, Sherman, Snyder, Stillwater, Wichita Falls, Winfield

THE WEATHERFORD TECHNIQUE

Your cement job is in good hands

The Weatherford Technique is your best assurance of a good cement job . . . the most advanced method known for the proper conditioning of the hole, preparatory to and during the running and cementing of casing.

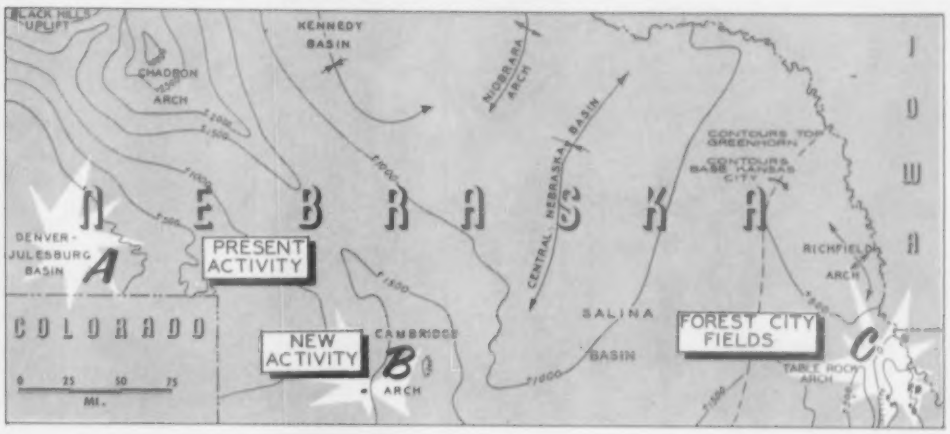
But it is more than that; the Weatherford Technique is the combination of men, equipment, know-how, and service that is being used by operators throughout the world for the successful production of pipeline oil.

The man from Weatherford: (1) surveys the well condition after the electrical log has been run, (2) recommends the proper type, number and spacing of scratchers and centralizers, (3) supplies and installs the equipment on the casing, (4) recommends the proper make-up of the cement slurry and the optimum running time, (5) expertly supervises the entire program, and (6) prepares a complete well report on the casing and cementing operation.

This Technique is indispensable to safe and economical completions. The man from Weatherford gives the job all he's got. You get a better cement job, more profit and less worry.

WEATHERFORD
OIL TOOL CO., INC.

GENERAL OFFICES: 5920 Navigation Blvd., Houston, Texas



Nebraska offers vast opportunities to the wildcatter on half a dozen regional uplifts and basins. Map adapted from E. C. Reed's "Structure Contour Map of Nebraska," in Oil and Gas Fields of Nebraska, Rocky Mountain Association of Geologists, 1956.

"What Nebraska Needs Is Wildcats . . . hundreds of them."

by Frank J. Gardner

IT'S been said that the golfer who fails to hole his putts just pays and pays and pays. The one who holes his putts just plays and plays and plays.

On a pile of rocks . . . Golfers aren't too different from wildcatters. Both are sports, both are persistent, and both are interested in the same thing—making a hole pay off. There's one big difference, though: the golfer must play where there's a course; the wildcatter can play 'most anywhere there's a pile of suitable rocks.

If the golfer wins, he's applauded. If the wildcatter wins, he's swamped with competition. This is bad? No, this is good. For this is how new fields are found. Competition means discovery.

But first, you've got to have a leader—sombody with adventure in his heart, gambling in his blood, a lease in his hand . . . and money in his pocket. Rocks in his head are a big help, too. When he hits oil, though, he finds himself surrounded with friends and competitors, and a new play is on. This is the way new "provinces" of oil are opened. This is the way it has always been. This is the way it will always be.

Take western Nebraska. Scene of the first field ever found in the Denver basin in 1949, it is today the setting for one of the busiest drilling campaigns in the Rockies (A on map). By now, it should have been "drilled up," but somebody hit down in Colorado and everybody went down there for a while. Now they're back in Nebraska. So it goes in the oil business.

Somebody has to hit . . . Now, somebody (M. P. Gilbert by name) has hit farther east (B on the map). Red Willow County, Nebraska, site of the state's first Cambridge arch field, is on everybody's mind. Of course, the Cambridge arch has been there for eons, offering just as good prospects of oil and gas traps as the Central Kansas uplift to the south of it. But nobody had hit oil on it. And if somebody else besides Gilbert doesn't hit soon, the arch will suffer the same fate as the Forest City basin. That's C on the map. In 1940, it was alive with drilling activity, but after finding a dozen or so oil pools, operators were discouraged by a low success ratio and war shortages. They've never gone back to it, and it has laid dormant for a decade.

Our Canadian cousins, especially those of the oil press, have developed a habit of pointing out with ill-concealed glee that "the United States is about drilled up." This misses the truth by a wide margin.

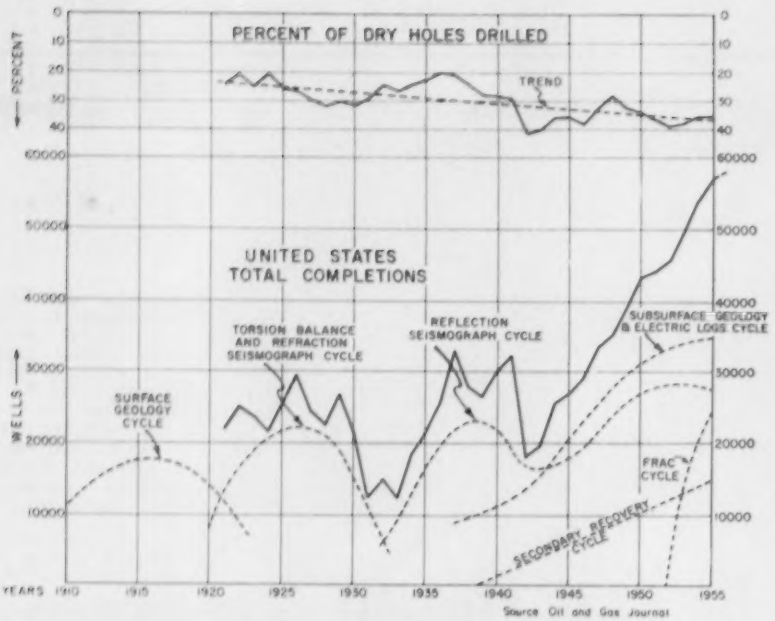
Take Nebraska, again. This one state offers vast areas of shallow drilling prospects with better-than-average chance of success. But a wildcat in any county outside those of the Denver basin is a rare item. As of today, two are active in Red Willow County on the Cambridge arch, and one in Dawes County on the Chadron arch in northwestern Nebraska. That's not much to brag about in an oil state that has so much to offer in the way of wildcat prospects.

Or it stands condemned . . . If one wildcat to every 200 sq. miles is "drilling up" an area, then we may consider the enormous Central Nebraska-Salina basin condemned. It covers 27,000 sq. miles in Nebraska and 14,000 sq. miles of northern Kansas. It holds 23,000 cu. miles of marine sediments with a maximum depth of 5,000 ft. It has everything necessary for the occurrence of oil: source rocks, reservoir rocks, myriad structures, porosity wedges, major unconformities (at least four), and evidence of the presence of oil and gas.

If one wildcat to every 258 sq. miles constitutes "drilling up" an area, let's condemn the Forest City basin, with its 15,000-sq.-mile area, 7,100 cu. miles of sediments with maximum depth of 4,000 ft., major unconformities, source rocks, reservoir rocks, plentiful structural and wedgeout traps, and a dozen good oil fields that were developed before the advent of postwar near-miracles in exploration and completion procedures.

The same condemnations might be applied to the sinuous Cambridge arch, the plunging Chadron arch, the Kennedy basin, the Richfield arch, or the south flanks of the Black Hills.

What Nebraska needs is wildcats—hundreds of them. And when one of them hits, a new "province" will have been discovered. It happened in the Denver basin. It happened in Red Willow. It'll happen on the Chadron, in the Salina, in the Black Hills. And Forest City will thrive again. You'll see.



SEVERAL EXPLORATION TRENDS are evident on the total-completions curve. Notice that the per cent of dry holes is declining (upper graph). Fig. 1.

Exploration trends seem to indicate . . .

A New Discovery Cycle Is in the Offing

by Paul Lyons

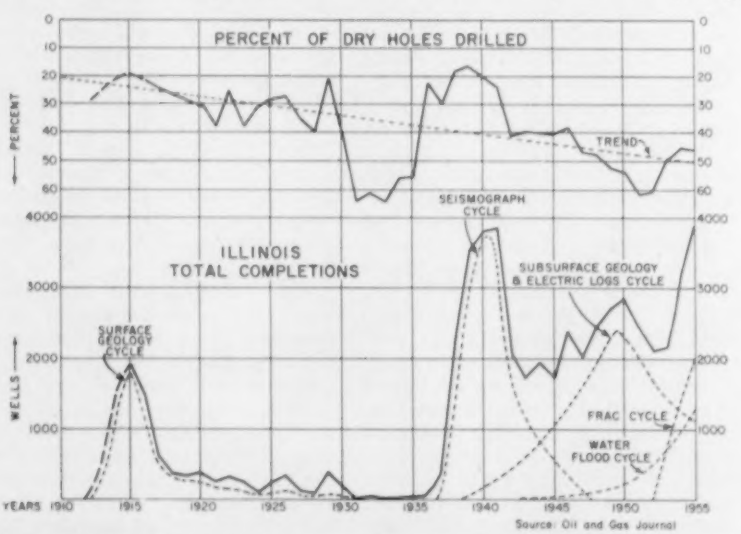
MODERN oil exploration is a product of teamwork. The scout, landman, geologist, geophysicist, and petroleum engineer are now working together to find oil. The ultimate in cooperation is rapidly being attained among these team members. And it has come about through stern necessity. Now oil is much harder to find in the United States than previously, and it often seems incredibly hard to find in terms of the effort and money expended. This aspect is right now contributing toward the exodus of much oil-finding effort and cash to foreign countries. This is the first trend called to your attention.

Of course, the far pastures look greener, and indeed they are often quite green. But the United States is still a giant among oil countries. The next trend called to your attention is that of United States oil production, which is still increasing each year. It is apparently increasing at a constant percentage each year; and each year a constant per cent rise of the previous year's production means that a greater increase of oil must be produced. The United States has consistently accomplished this, and the present cycle of the oil business has not yet reached a crest, nor has it shown signs of slackening the dizzy pace. Reserves increased a modest ¾ billion barrels last year in spite of increased production which reached nearly 2½ billion barrels. Thus, 3¼ billion barrels of oil was found in 1956.

What is the exploration background for this ever-increasing production? Naturally, a great increase in the number of wells drilled is a necessity for such a rise. Note this trend: A significant sustained rise in total completions started in 1942. This has been maintained and more than three times as many wells are drilled now in a year than were drilled in 1942 (Fig. 1). It almost seems that the drill is running away from us. But there was an ample scientific background which made this drilling and production program possible.

Note the several cycles of exploration techniques which have influenced the total completion chart. In the second decade of this century, surface geology made a great contribution to discoveries and resulting drilling and production. This was followed in the twenties by the seismic refraction and the gravity torsion balance programs which found so many salt domes in the Gulf Coast area. In turn, this was followed by the even more brilliant successes of the reflection seismograph which dominated the thirties.

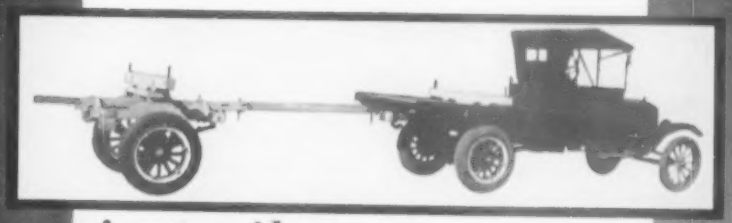
Big push . . . But the really big push of the forties and the first half of the fifties has been brought about by the coalition of no less than four exploratory cycles. The seismograph continues but is dominated by subsurface geology,



THE FACTORS OR TRENDS that have influenced drilling are even more apparent in local areas such as Illinois. Fig. 2.

Author is with Sinclair Oil & Gas Co., Tulsa. Article presented at National Oil Scouts and Landman's Association Annual Convention, Corpus Christi, Tex., 1956.

40 Years of Being First



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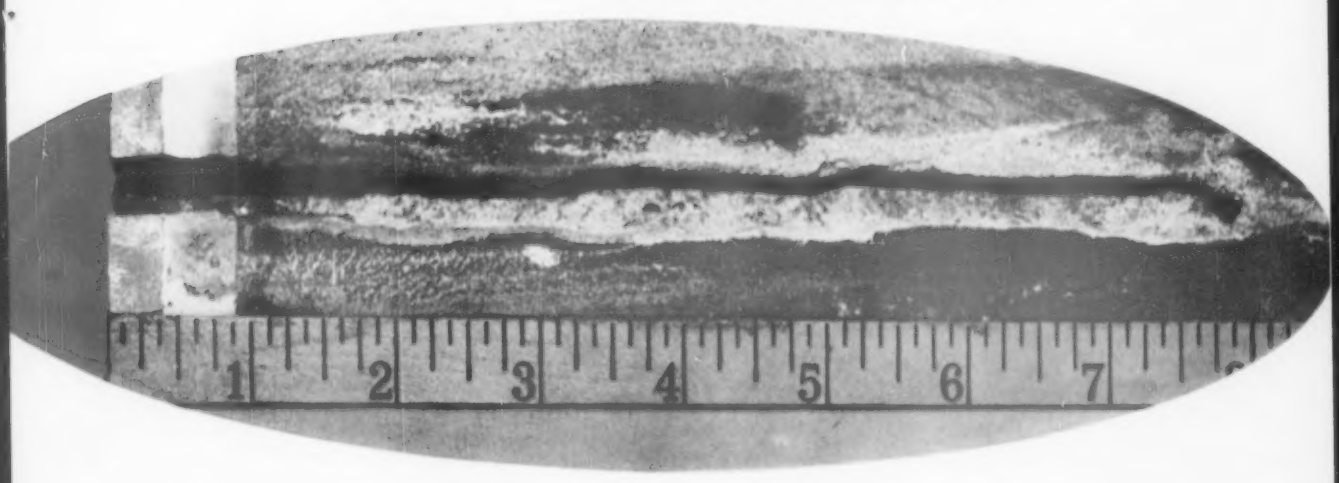

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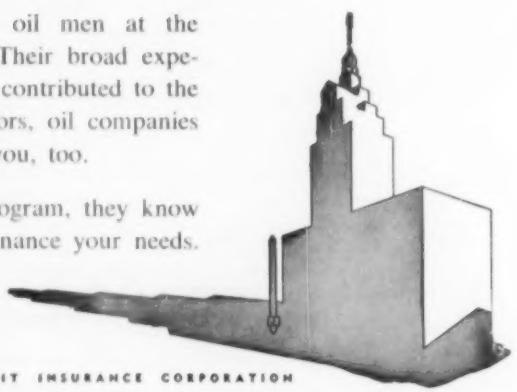

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which has been aided tremendously by that potent geophysical oil finder—the electric log. And a new member of the oil-finding team appears, the petroleum engineer. Through these men, the petroleum engineers, two cycles of very real oil-finding techniques, secondary recovery, and the more recent fracturing, have entered the picture. As a part of their contribution, deeper drilling and offshore drilling enter the picture.

It would appear that the present trend of ever-increasing drilling and production is due to the coordination and simultaneous operation of all these oil-finding techniques.

This is a very fortunate thing, for it is apparent that our technology, research, and determined effort have combined to squeeze out more and more oil from the earth of the United States. If tremendous advancements over the techniques of the thirties had not been made, our completion curve would almost certainly have gone down instead of up.

In this rather bright picture must be included the shadow of the persistent dry hole. A trend of increasing dry-hole percentage is quite apparent. Whereas some 24 per cent of all wells drilled for oil and gas in the early twenties were dry, the figure now stands at about 36 per cent for the United States, or a 50 per cent increase.

Local trends . . . The exploration trends and cycles noted for the United States stand out in much greater clarity if the chart is restricted to one geological or production area (Fig. 2). Illinois is such a representative area, and your attention is brought to the precision with which the several exploration cycles are etched on the curve of total completions.

In Illinois we detect the impact first of surface geology. Note that drilling declined to almost zero in the early thirties, so that Illinois almost ceased to be mentioned in the issues of The Oil and Gas Journal, source for these figures. In no area did the reflection seismograph have a more dramatic impact. Drilling and production rapidly soared to a high peak in an area presumed to be entirely depleted of oil and gas by many authorities. And then the state was written off by many as production declined, and yet once again there has been a resurgence; this time because of the coincidence of the application of subsurface geology, electric logs, secondary recovery, and fracturing. Last year, total completions reached the highest peak in history.

Will you consider again the persistent dry hole. An effect that is not readily apparent in the nation-wide picture is present in local pictures such as this. A relatively high percentage of dry holes will discourage drilling even within the year of its occurrence, so that an excellent correspondence or correlation is apparent between the dry-hole curve and that for total completions.

Such bad news travels fast and has such an immediate effect. Of course, good news may be seen to have the opposite effect, and the upsurges of the drilling curve which follow discoveries are paralleled by a rapid decrease in the percentage of dry holes drilled.

Nevertheless, that most troublesome increase in the percentage of dry holes is even more pronounced in Illinois, where it has gone from 20 to 50 per cent in the 40-year span of our chart.

Reflect on the economic significance of the 50 per cent dry-hole ratio in Illinois. If half the wells drilled are dry, then each well's production should yield enough return to equip one well, drill two, and pay this out in a reasonable time. Such a performance is probably beyond the productive ability of a high percentage of the producers drilled today in Illinois and in the United States. Here is a good reason for no proration in Illinois.

This inexorable increase in dry holes is caused by exploration failures, just as the increase in total number of successful completions is due to exploration successes. Yet there is no paradox here.

Seismic efforts . . . It seems that our exploration successes are more numerous than ever, but the finds are smaller. As a result, each successful wildcat leads to fewer developmental wells than in previous years. Note the trend in seismic exploration, which is a very convenient yardstick for industry. The activities of seismograph crews cannot be concealed, consequently their activities and results are reported and may be used for statistical purposes.

Thus, the number of geophysical new-field discoveries has risen in proportion to the rising employment of seismograph crews, but the total amount of oil found has not increased correspondingly with the effort. Actually industry is drilling a greater number of wildcat wells to find the same amount of oil. This number is over 1,500 per year in late years, based on seismograph pictures, and with even more locations based on subsurface work. A seismograph crew must now work for 30 months to find enough prospects to include one successful prospect, and a seismic crew works a year to find a little over 1½ million barrels of oil.

Very small structures are being sought and found in Oklahoma, for example. It is readily apparent that structures of small areal extent and small closure are far more difficult to find than large structures. And so, in a great many places our increased ingenuity and effort are being expended on small "hickeys." Actually, five out of six fields presently being discovered in the United States have less than 1 million barrels of reserves. Many authorities think fields of this size are unprofitable. If such discoveries are not called successes, and we must of course call them successes until we know more about them, then about 98 per cent of all wildcats, instead of 89 per cent, are failures.

There are of course exceptions to everything. Well over a hundred seismograph crews are currently being employed in southern Louisiana, and the search there is for small structures, for the large structures have been found long since. The indications are that the small structures being found are profitable, since the area, with its multiple-sand possibilities and high success ratio, is exceptionally good.

Exploration costs are rising rapidly, also. For example, the cost of finding oil by geophysics, since we have good statistical control on geophysical costs, is about half the value of the oil and gas found in the ground. This includes the lease, wildcat drilling costs, and completion costs on successful wildcats.

Frontiers . . . One cause of these disquieting figures is the transition in the United States from frontier areas to areas where the cream has apparently been skimmed off. The best frontier we have remaining is the offshore area of Louisiana. With only a small percentage of the area under development, the wildcat success ratio is 50 per cent or better and the production has just passed 100,000 bbl. per day.

This is a splendid example of what modern scientific exploration can accomplish in a new area with a good petroliferous sedimentary section. There are other frontier areas available, but only a few of them are presently coming into the field of favorable regard to merit determined exploration by the drill.

One such example is Nevada, where even the successful completion of a commercial wildcat by Shell has not kicked off a big enough drilling program to add any more to the picture. Yet we know that oil is not singular in its occurrence, and it is a maxim of the business that one discovery begets many more.

There is one other over-all conclusion or trend that we can draw from statistics on the use of seismograph. The success ratio for discoveries by seismograph has remained 1:6 for wildcats for many years despite the necessity of finding smaller and smaller

anomalies. The same is approximately true of geological exploration and exploration initiated by geologists, landmen, and scouts. That is, the technical discovery efficiency must be better since the targets are smaller and when frontier areas such as the offshore are considered, the discovery efficiency is a lot better.

Acreage factor . . . But this is not the entire picture and I should like to present to you some figures involving the over-all exploration efficiency of the major companies. Statistics are available from their annual reports, and through information services.

The major companies have about 150 million acres of unproved, or unoperated acreage, under lease in the United States. This is the prospective acreage on which all new oil pools will be found that are found by major companies. For any year, we can divide the oil found by these companies by the unoperated acreage held to get a discovery efficiency figure. That is, we can find out how many barrels of oil are found per undeveloped acre under lease. The more efficient the over-all exploration in terms of oil, the higher will be this number.

For every undeveloped acre held under lease, the major companies were finding 23 bbl. of oil in 1940. This declined to 11 bbl. found per undeveloped acre in 1945.[1] This figure was 7 bbl. per acre in 1955, from available figures. That is, we can predict the amount of oil to be found this year, or next year, by multiplying the amount of unproductive acreage under lease by seven. If a given company is not finding 7 bbl. of oil per each undeveloped acre it has under lease, it is not as efficient as the average in this respect.

Since the efficiency is declining, the major companies have sought to find more oil by holding more acreage, a natural reaction. In the last 10 years the major companies increased their acreage holdings in the United States by 80 per cent.

It is an amazing fact that this drive for acreage has caused large areas of petroliferous territory to be almost 100 per cent leased up. This high percentage of leasing even extends to places such as southern Florida, which is more than 90 per cent under lease despite wildcat efforts for many years to find just a second pool. Only one pool has been found in southern Florida.

In the United States, it would appear in the past several years that a decline has been registered, (about 5 per cent last year) in the amount of undeveloped acreage held by major companies, this indicates the acreage burden is too heavy. This inability of the majors to hold all the good prospective acreage, more than any other factor, has permitted the oil business, unlike the autmobile business, for example, to remain fiercely competitive with hundreds of companies and individuals participating. The East Texas pool, for example, had well over 700 companies represented by holdings of producing leases.

But the over-all significance, as far as exploration is concerned, is that a decrease in exploration efficiency has occurred in the United States in spite of increased technical efficiency due to the rise of new methods and techniques.

Demand . . . We must not forget that we are not dealing with a static situation as far as demand is concerned. We are faced with estimates that in 10 years an annual production of 3.9 billion barrels and an annual discovery of 6.4 billion barrels are needed, which is more than twice the amount found last year.

What is to be done about this? Can our discovery effort in the United States be further spurred so as to not only hold level, but to increase twofold in 10 years? Is the economic climate right, and are the prospects right? These are the most pressing and important questions facing the oil business in the United States.

There are several considerations to be made, each of which will affect the final answer. One of these is that in the United States there are more major pools waiting to be found.

It has been said that our exploration effectiveness has declined because all the obvious oil fields have been found. This is very true. But those fields were not obvious until all the information had been assembled and all the exploration necessary had been done. The oil fields of the future will look obvious, too, once they have been found.

To make this point, and to illustrate the oil that will be found in the future, let me call attention to a few more or less recent discoveries that were not obvious, at least until they were found.

There is a vast gas pool in the center of the San Juan basin of northwestern New Mexico. This accumulation occupies a large syncline, without benefit of anticlinal structures. The productive beds outcrop all around the basin, and the gas is probably trapped by permeability barriers, with the exception of the northwest flank of the occurrence. There water is on contact with the gas, but updip from it. If any obvious conclusion can be made, it is that the gas should have long ago escaped the outcrop.

Recently a bar of productive basal Pennsylvanian sandstone, 1 or 2 miles wide and apparently 40 miles long, was discovered in north central Oklahoma. This was neither obvious nor unexpected. Similarly, a thin band of productive porous Pettet limestone, the Crane trend, has been outlined in northeast Texas and northwest Louisiana. This gas condensate pool also appears to be more than 40 miles long and 1 to 2 miles wide and the trend has several branches.

Simpson Formation

Several months ago, British-American Oil Producing Co. discovered what appears to be an excellent pool in the Simpson formation of Oklahoma at 14,000 ft. This is well down on the flank of a huge anticline (Carter Knox). Prior to this discovery, the surface crest was the obvious place for the oil.

Some oil companies already have employed geologists who confine their mapping entirely to stratigraphic traps for oil and gas. Geophysical work is now being directed toward the finding of stratigraphic traps, and the seismograph records more and more are being regarded as stratigraphic record.

Summary

We find in our trend of exploration for oil and gas in the United States many unfavorable, discouraging aspects, and many encouraging aspects. Among the former are the considerations that ratio of dry holes to completions is increasing, that the costs of finding oil are increasing, the size of our finds is getting smaller, and that our discovery efficiency for the prospective acreage under lease is decreasing.

Although it almost seems that we are squeezing the last blood from the turnip, we are faced with the necessity of increasing the rate of squeeze. On the brigter side, our technical exploration efficiency is actually higer, due to ever increasing cooperation of our many kinds of oil finders, and to the increased number of improved techniques and ideas we have collectively brought to bear. Our drilling is increasing to meet the need, and our experience and information about oil is making us more effective. Best of all, there is a vanguard of determined exploration into many unexploited areas and depths that seems destined to bring about a new cycle of discovery.

References

1. Herold, J. S., "Prospective Acreage as a Measure of Discovery Efficiency," The Oil and Gas Journal, April 22, 1948.

2. Knebel, G. M., and Rodriguez-Eraso, Guillermo, "Where Are the World's Giant Fields," The Oil and Gas Journal, April 30, 1956.

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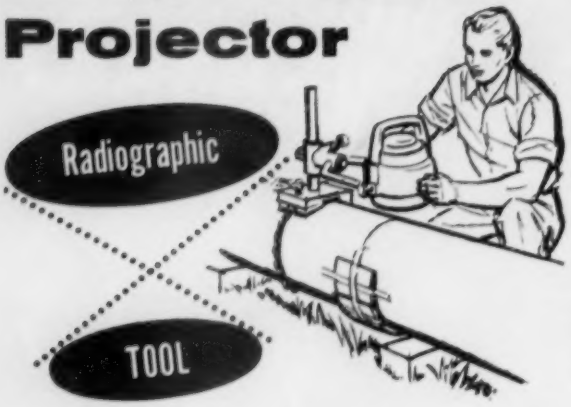

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EXPLORATION HIGHLIGHTS

MID-CONTINENT

OKLAHOMA

Flowing Oil Creek Oil Found at Velma Dome

Flowing oil production in the Oil Creek sand was reported at The Texas Co. and Mercury Drilling Co.'s Velma field test. The 1 Prichard, a geological wildcat in SE SE SW 4-2s-4w, near Velma field, Stephens County, flowed 284 bbl. of oil per day on ¼-in. choke from perforations at 8,982-9,010, 9,102-24 and 9,032-36 ft.; it flowed 165 bbl. in 15 hours on 10/64-in. choke and 60 bbl. in 6 hours on 6/64-in. choke.

McLish Pay Found at Eola Area Test

A drill-stem test in the McLish sand at 1 Milburn in C SW SW 3-1n-3w, 1½ miles west of the deep Eola field, Garvin County, flowed 2,530 M.c.f. of gas per day at 9,894-9,948 ft. The Superior Oil Co. well recovered 525 ft. of oil and gas-cut mud with a trace of distillate.

Ordovician New Pay Strike Near Velma

A new-pay discovery in either the basal McLish or Oil Creek sands of Ordovician age is reported near Velma pool. The indicated discovery well is The Texas Co. and Mercury Drilling Co. 1 Prichard, SE SE SW 4-2s-4w, Stephens County.

The well flowed 165 bbl. of oil in 14 hours on 10/64-in. choke from perforations at 8,982-9,010, 9,012-24, and 9,032-36 ft.

NORTH TEXAS

Foard County Confirmation Runs Pipe for Tests

Central Foard County had prospects of a confirmation well to the new Effie-Bend conglomerate field 3 miles southeast of Crowell. The south offset to the discovery is Panhandle Oil Corp. 2 Effie Bell. Operators reported a strong blow of gas and recovery of 2,590 ft. of oil on drill-stem test of the conglomerate at 5,417-29 ft. Flowing pressure on the test ranged from 210-515 psi. Following the test, pipe was being run to total depth at 5,466 ft. for completion tests.

No. 2 Bell logged the conglomerate at 5,414-29 ft., and top of the Mississippian at 5,438 ft. Location is in the Abb Luce Survey. Panhandle 1 Bell was the field discovery, flowing 440 bbl. of oil a day through 24/64-in. choke from pay at 5,410-18 ft.

Other tests in Foard County are Tennessee Gas Transmission Co. 2 Carroll, a development well 12½ miles northwest of Crowell, which was drilling below 5,638 ft. in shale. Pay section in the Caddo is expected around 6,100 ft. The Texas Co. 20 Johnson, new wildcat 15 miles southwest of Crowell in C. Choate Survey, was rigging up at last report.

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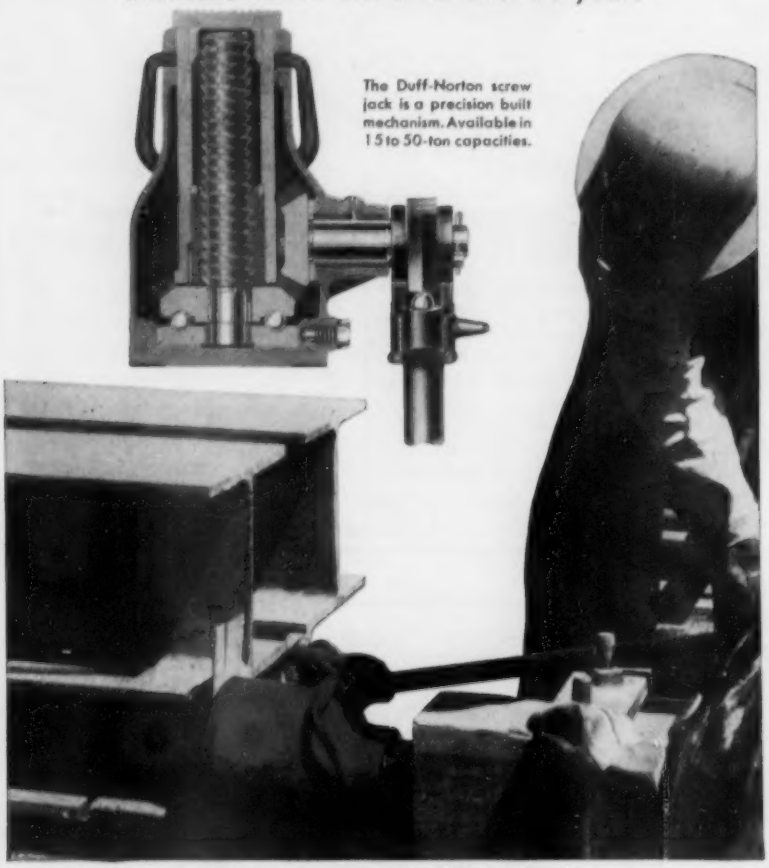

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ROCKY MOUNTAIN

MONTANA

Locations Announced In Disturbed Belt

Two joint wildcat endeavors were announced last week by Gulf Oil Corp. and Stanolind Oil & Gas Co. east of the mountain front in Montana's Disturbed Belt.

Gulf Oil Corp. 1 Blackfeet-Federal, C SE SE 14-37n-15w, Chief Mountain area, will test to the Madison at 13,000 ft. This well is just south of the International Border, 20 miles south of Canada's Pincher Creek field.

The second Disturbed Belt wildcat will be in Lewis and Clark County, 125 miles south of the Chief Mountain well. This one, Stanolind 1 Gelsinger, C SW SW 32-20n-7w, Haystack Butte area. It will go to the Madison at 9,500 ft.

UTAH

Casing Set at Paradox Discoveries

The two latest discoveries in the Aneth trend of San Juan County, Paradox basin, have casing set. The Texas Co.'s 1 Navajo-J, C NE NE 20-40s-26e, on the east end of the trend, went to 5,832 ft., total depth. Shell Oil Co.'s Recapture Creek wildcat on the west end of the Aneth trend, C SE SW 21-40s-23e, has casing run to 5,526 ft. Both these wells recovered substantial amounts of oil from the Paradox-Pennsylvanian.

North Desert Creek . . . The North Desert Creek discovery well has been completed for 1,440 bbl. of oil per day from the Paradox. Shell's prolific discovery was completed flowing on 48/64-in. choke. Total depth was 5,624 ft. in the Paradox.

Rank Wildcat Announced

A rank wildcat 25 miles northwest of Blanding, Utah, is the first active test of the Paradox basin holdings of Texota Oil Co.

Stanolind Oil & Gas Co. has made location for 1 Federal NW SW SW 2-34s-19e, in the Elk Ridge Unit, San Juan County.

The Stanolind well is to go to Devonian at about 4,850 ft. There has been no previous drilling closer than 8 miles to the southwest. There, in 1927, Midwest Oil Co. bailed 5 bbl. of oil per day from Mississippian. The well was abandoned, since modern production stimulation methods for tight formations were not then in use.

The well is more than 45 miles northwest of the growing Aneth area, where two new discoveries within the past few days have outlined an area of prolific production of more than 18 miles in east-west extent, more than 10 miles north and south.

Gas and Oil Shows Found at Emery Test

A rank wildcat in the Moonshine Wash area of Emery County, 25 miles southwest of nearest production at Crescent Junction, recovered oil and gas on drill-stem tests. The well is Standard Oil Co. of California's 1 Unit, C NE SW 32-25s-15e. The test was taken at 5,521-5,601 ft. Recovery was 750 ft. of watery drilling fluid, gassy, with an oil scum, and 2,540 ft. of slightly gassy, black sulfurous water with oil traces. Coring continues below 5,607 ft.

NEBRASKA

Cheyenne County Gas Discovery Completed

A new "J" sand gas discovery well was completed in Cheyenne County, 4½ miles west of gas production at Peetz field and 2 miles southeast of Bukin-State oil field.

The discovery is Shell Oil Co. 1 State, C NE SE 16-12n-53w. The well flowed 1,666 M.c.f. of gas per day on 16/64-in. choke from perforations in the "J" sand. The now shut in gas discovery is just north of the Colorado state line.

GREAT LAKES

MICHIGAN

Second Salina Test Shows Gas

The second Salina dolomite gas test in Overisel Township, Allegan County, showed for 560,000 cu. ft. of gas a day on a 3-hour drill-stem test run in this objective between 2,652 ft., and total depth, 2,675 ft. Well was ready for acid after long string of 7-in. casing was cemented in at 2,652 ft. This new potential gas well is the Taggart Co. 1 Krooze, Busscher, Koopman, C NW 16-4n-14w. This initial showing was approximately double the amount of gas logged at the so-called Salina gas discovery well, the approximate south offset to this well, which was not ready for completion yet due to a faulty casing seat. This second potential producer was reported to have logged at least 16 ft. of solid dolomite in the Salina. No exact determination of what

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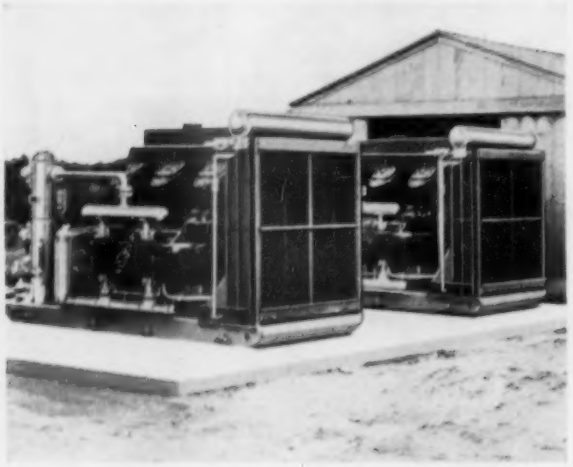

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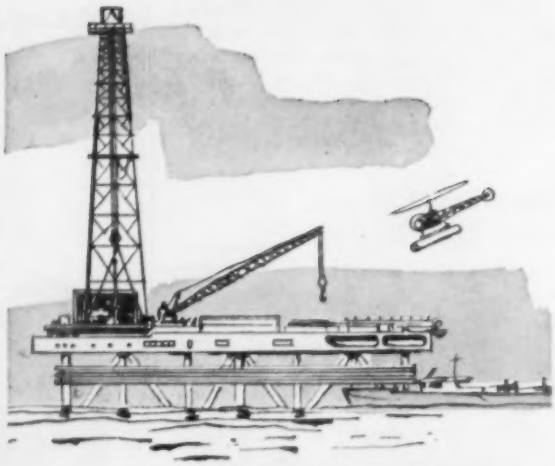

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part of this dolomite was effective pay had been made.

The Taggart Co. had location staked for gas test No. 3 in the area, at the 1 Hoffman-Klaffen, C SE 16-4n-14w, which will be drilled immediately.

Another interesting Salina section showing was being prepared for acid treatment in Hopkins Township, Allegan County. Oil Producers, Inc. logged 65 ft. in scattered oil saturation in the Salina between 2,687-2,900 ft. at the 1 Schafer, NW NE SW 18-3n-12w. On overnight fill-up tests, this wildcat showed for 200 to 300 ft. of free oil. Hole was bottomed out at 3,140 ft. but was being plugged back to 2,895 ft. prior to acid treatment. Long string of 5-in. casing was set on a packer at 2,664 ft. This is the first deeper horizon test well drilled in the area of the older Hopkins Traverse oil pool.

PACIFIC COAST

CALIFORNIA

Union Gets Pliocene Find at Bardsdale

Union Oil Co. of California is the latest company to successfully drill through the Oakridge uplift in Ventura County to score a major Pliocene pool discovery. Union's find is at Bardsdale, approximately 8 miles east of the prolific Bridge area of South Mountain field. It was completed flowing 625 bbl. daily of 32.2°-gravity crude through a 24/64-in. choke from an interval at approximately 6,350 ft. The well, 1 Irwin Berylwood, is located on the west edge of Bardsdale field. Prior to Union's Pliocene discovery, all production at Bardsdale was from shallower Oligocene or Eocene sands found on top of the steeply overturned Oakridge uplift.

Humble Completes Second Fillmore Well

Humble Oil & Refining Co.'s southeast offset to its first well in the deep Fillmore field of Ventura County was completed flowing 456 bbl. daily of 31.4°-gravity crude through a ¼-in. choke. The perforated interval is between 13,834-13,930 ft. Total depth of this well is 14,020 ft.

Bandini Gets Third Flush Well at Devils Den

Bandini Oil Co. completed its third big producer in the shallow pay on the north edge of the Devils Den field in Kern County. Bandini 5 U. of C. was brought in flowing 230 bbl. daily of 44.8°-gravity crude through a 13/64-in. choke from selectively perforated in-

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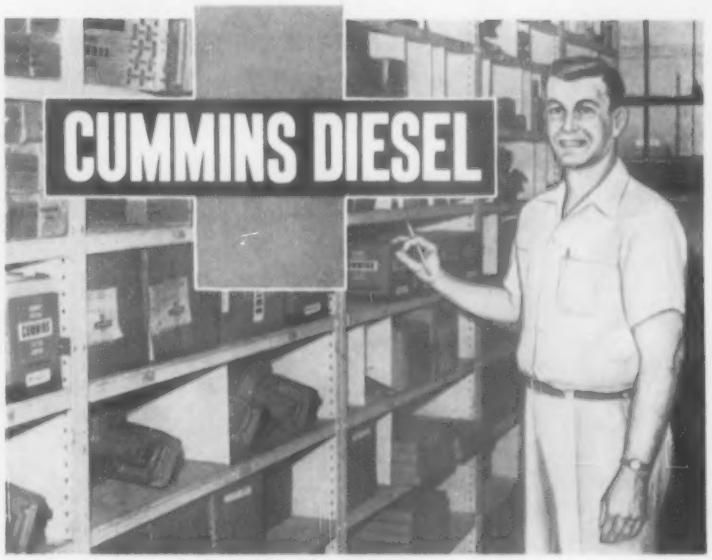

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tervals between 3,517-3,752 ft. Total depth is 3,840 ft. Bandini's lease is on acreage owned by the University of California.

BASIN AND RANGE

NEVADA

Shell Drills Ahead At Diamond Valley

Shell Oil Co.'s latest effort to find additional Nevada production, a wildcat in Diamond Valley, Eureka County, was drilling ahead below 6,474 ft. after coring conglomerate at 6,027-32 ft. This wildcat, 1 Diamond Valley Unit, is located approximately 100 miles north of Shell's production at Railroad Valley in north-central Nevada. Projected total depth of this wildcat is 7,500 ft.

WESTERN CANADA

ALBERTA

Gas Reported at Porcupine Hills

British American Oil Co., Ltd., has indicated gas success at its current wildcat driller in the Porcupine Hills area of southern Alberta, 13 miles southeast of the Savanna Creek gas producing region, 27 miles south of the southern limits of the famed Turner Valley oil field and 26 miles west of the town of Stavely. Discovery was made in the basal Blairmore sector and during drill-stem test operations a flow rate of 7,000,000 cu. ft. daily which decreased to 2,700,000 cu. ft. daily, was encountered.

This well, 2-29 Rocking "P," on LSD 2, 29-13-2w5, is slated as a Mississippian test and at its present depth of 10,952 in the Blairmore formation is nearing that formation.

Drill-stem test to indicate success was run of the interval 10,870-10,952 ft. Gas flow reached the surface in 66 minutes at the maximum rate of 7,000,000 cu. ft. daily and decreased to 2,700,000 cu. ft. daily in 129 minutes. Pipe recovery consisted of 1,080 ft. of water cushion and 180 ft. of drilling mud.

Cardium Show Hinted At Warburg Wildcat

Cree Oil of Canada, Ltd., reported that its 7-10A Warburg wildcat well in the Warburg area of central-west Alberta, 19 miles east of the Pembina oil field and 40 miles southwest of Edmonton, gave a show of oil during a

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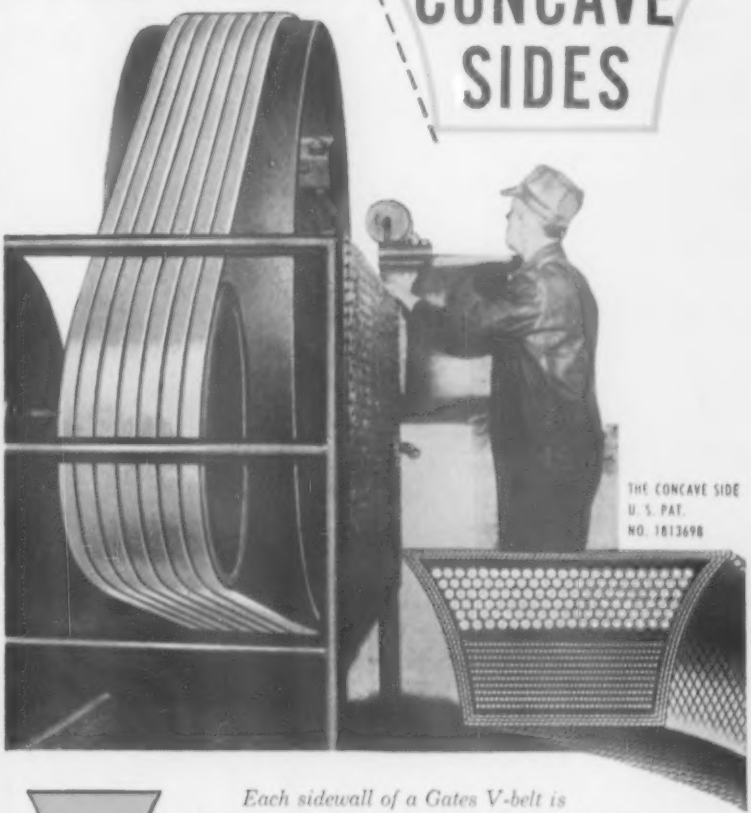

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TPA 109

Gates

Gates VULCO ROPE Drives

Cardium sand drill stem test and has assured its backers of gas success in the Viking sand formation. The well, being drilled on LSD 7, 10-48-3w5, previously was chalked up as a Belly River zone gas discovery. The venture is scheduled to test the Mississippian and at last report crew was making hole below the 5,400-ft. level.

Cardium zone drill-stem test gave up 35 ft. of oil-cut mud while tests in the Viking sand, around the 4,950-ft. level gave gas at a maximum rate of 5,700,000 cu. ft. daily. Two previously reported Belly River drill-stem tests at the 3,200-ft. level indicated a gas flow of 3,500,000 cu. ft. daily.

APPALACHIAN

OHIO

Oil production has now spread to the area north of New Lexington in Pike Township, Perry County. Mid East 1 (2) McGonagle, Section 4, logged the Clinton at 3,190-3,250 ft. with a gage of 60 bbl. in the first 24-hour test after fracture.

• A west offset and addition to the new gas pool in Central Knox Township, Holmes County, was completed by Oxford Oil on 1 H. E. Gray, Section 17. Clinton at 2,978-2,992 ft.

HUGOTON EMBAYMENT

TEXAS PANHANDLE

First Panhandle Chester Production Hinted

Shamrock Oil & Gas Corp. 1 Sedeck et ux, a Hansford County wildcat in Section 31, Block 4-T, T&NO Survey, may be the first Chester-Mississippian producer in the Texas Panhandle. A drill-stem test at 6,685-6,716 ft. got 90 ft. of slightly oil-cut mud, 180 ft. of heavily oil-cut salty mud, 1,180 ft. of heavily oil-cut salt water.

This highly important prospect is 2½ miles northeast of Spearman. The Chester does not produce anywhere in the Texas Panhandle, but is a well-known pay zone in Beaver County, Oklahoma Panhandle.

Stevens Field in Sherman Is Rank

Rank wildcat discoveries in the Hugoton embayment are getting more common each month, but here's one that outdoes them all for 1956. Phillips Petroleum Co.'s 1 Brady "E," Section 221, Block 1-C, GH&H Survey, Sherman County, is 45 miles west of

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NOTICE—Sale of oil and gas mining leases, tribal and allotted Indian lands. Department of the Interior, Bureau of Indian Affairs, Navajo Indian Agency, Window Rock, Arizona. Sealed bids will be received until 2:00 P. M. Mountain Standard Time and opened at that time in the office of the Navajo Indian Agency, Window Rock, Arizona, on the following tracts of Navajo tribal and allotted lands on the dates indicated as follows: Group 3: Bids to be Opened: 11-1-56: Tracts Nos. 100, 101, 109, 112, 113, 115, 120, 122 and 122 to 180 inclusive, totaling approximately 123,612.57 acres. Group 2: Bids to be Opened: 11-13-56: Tracts Nos. 53, 54, 55, 56, 57, 58, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 93, 94, 95, 96, 97, 98 and 99, totaling approximately 82,200 acres. Group 1: Bids to be Opened: 11-23-56: Tracts Nos. 1, 2, 4, 5, 7, 9, 13A, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 52A, 52B, and 53A to 72A inclusive, totaling approximately 158,505.40 acres. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the General Superintendent of the Navajo Indian Agency, Attention: Branch of Realty, Window Rock, Arizona.

LEGAL

Sealed bids will be received until 1:00 P.M., Monday, October 15, 1956, and opened at that time at the Shawnee Area Field Office for the leasing of allotted Indian lands located in Cleveland, Pottawatomie, Lincoln, Payne, Oklahoma and Logan counties, Oklahoma, for oil and gas mining purposes. For additional information write or telephone Mr. Robert D. Grover, Area Field Representative, Shawnee, Oklahoma. (Telephone 318).

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington, D. C. By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952, and Public Land Order No. 1298 of May 4, 1956, notice is hereby given that 538.48 acres of land including parts of secs. 3 and 12 in the University Leagues Subdivision, Blocks, 1, 11, 15, and 16, in Grayson County, Texas, situated within the Perrin Air Force Base, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 P. M., E.S.T., on October 31, 1956. Details of the lease offer, copies of the lease agreement with plat of lease area and special stipulations as to use and protection of the property and drilling requirements, and bid forms, may be obtained from the Oil and Gas Supervisors of the Geological Survey at 239 Federal Building, Tulsa, Oklahoma, and at 333 St. Charles Avenue, New Orleans 12, Louisiana; the Commander of the Perrin Air Force Base, Sherman, Texas; or the Washington office of the Bureau of Land Management, or the Land Office at Santa Fe, New Mexico. L. E. Hoffman, Minerals Staff Officer.

Statement of the Ownership, Management, Etc., of

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October 8, 1956

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S. H. ROURKE,
Business Manager.

Sworn to and subscribed before me this 26th day of September, 1956.

ROBERT D. FUNK,
Notary Public.

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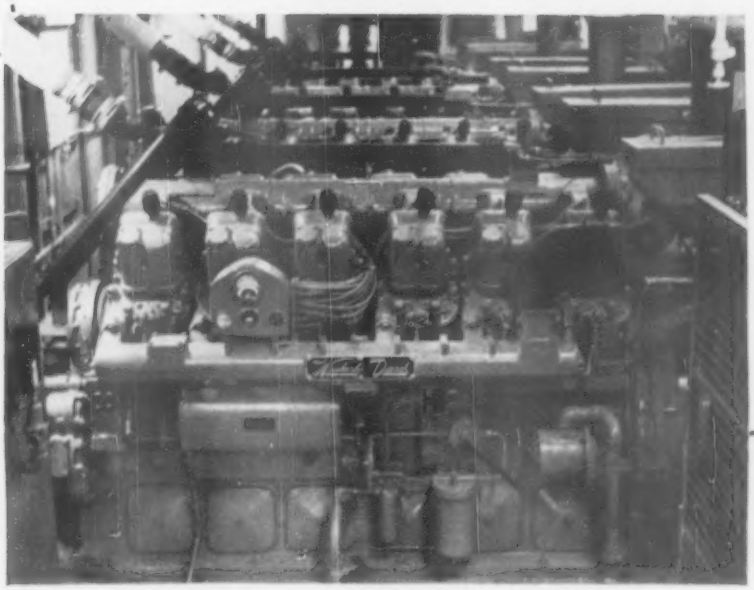

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Mississippian production in Hansford County's Spearman area, and is farther than that from oil production of any kind. The well made 40 bbl. of oil per day from the Mississippian oolitic lime topped at 6,412 ft. It is just west of Texas Hugoton gas field's western edge near the Stratford dome area.

OKLAHOMA PANHANDLE

Cabot Takes Potential At Beaver Hoover Hit

Cabot Carbon Co. took potential on its 1 Otto C. Barby "E" gas discovery in SE NW SE 31-4n-28eCM, Beaver County. The Hoover sand gas well flowed 32,415 M.c.f. per day from perforations at 4,318-34 ft. Location is 12 miles west of Laverne field in Harper County.

Lansing Oil Found at Northwest Ridgeway

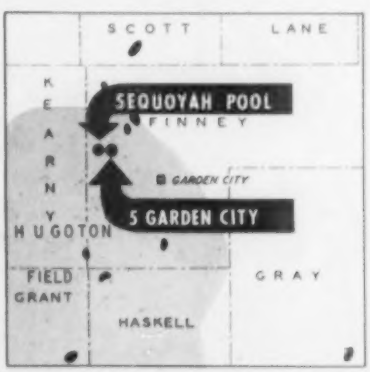
Beaver County's Northwest Ridgeway field, previously a Morrow-Chester gas area, has promise of oil production in the Kansas City-Lansing (Missouri). The indicated discovery well is Cabot Carbon et al. 1 Hageman-Barby, C NW SE 28-4n-25eCM.

A drill-stem test at 5,460-68 ft. recovered 300 ft. of oil and 60 ft. heavily oil-cut mud. Drilling continues on to the Chester-Mississippian.

SOUTHWEST KANSAS

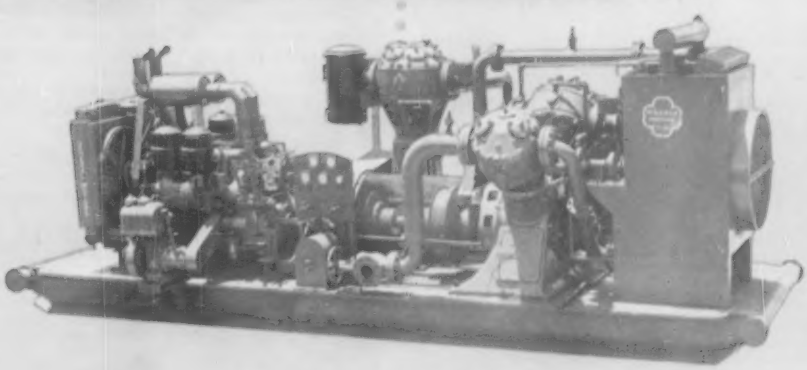
Morrow Discoveries Inside Hugoton Field

A new Morrow oil pool was officially opened last week inside Morrow Permian gas field. Northwest of Garden City in Finney County, Champlin Refining Co. completed 2 Leavitt, C 17-23s-34w, pumping 177 bbl. of oil



Champlin Refining Co. officially opened Sequoyah-Morrow oil pool inside Hugoton gas field, and has a second indicated strike just 1 mile east.

proven in the field!



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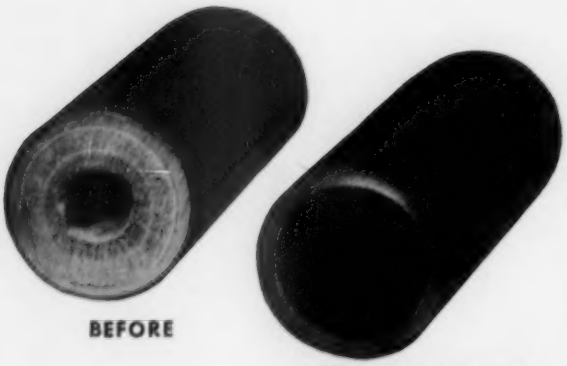

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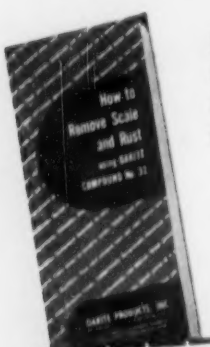

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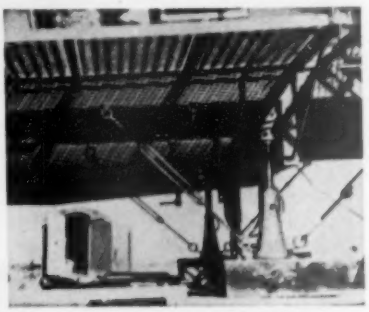

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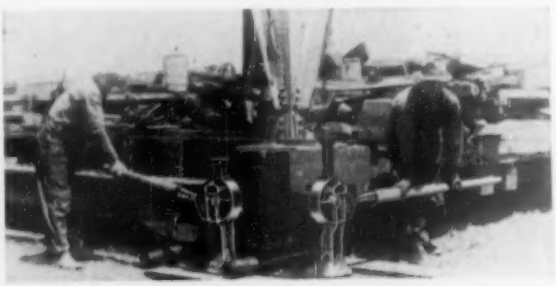

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per day from perforations in the Morrow sand at 4,694-4,704 ft.

Just 1 mile east at 5 Garden City in C SE NW 16-23s-34w, a drill-stem test at 4,649-57 ft. recovered 840 ft. free oil, 80 ft. of oil-cut mud, and 10 ft. muddy water.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Second Zone in Andrews Strike Makes Heavy Flow

Andrews County's dual discovery, W. E. Blake 1 Grady, southeast of Andrews, last week ran potential on the Devonian pay section. A 12-hour flow test of 654 bbl. of oil through ¼-in. choke gave the well a daily potential of 1,308 bbl. Gravity was 48.7°, gas-oil ratio 732:1 and flowing pressure was 1,100 psi. Pay section was perforated at 10,536-54 ft.

The well's first potential was in the Ellenburger at 12,312-53 ft., where it flowed 1,022 bbl. of oil a day through ½-in. choke.

Thick Pennsylvanian Reef Indicated in Dawson Test

Seaboard Oil Co. 1-A Weaver, discovery prospect 5 miles west of Lamesa in Dawson County, had recovered oil on its fifth consecutive test in reef limestone.

Drill-stem tests at 8,963-83, 9,002-34 and 9,034-67 ft. recovered oil and mud, and at 8,963-9,009 ft. operators reversed out from 25-30 bbl. of oil. The fifth test, at 9,064-97 ft., had gas in 10 minutes, and recovered 6,541 ft. of clean oil plus 175 ft. of heavily oil and gas-cut mud. Bottom-hole flowing pressure was 180-1,790 psi., and 15-minute shut-in pressure read 3,660 psi.

Seaboard Oil Co. 1-A Weaver, Dawson County wildcat west of the town of Lamesa, had a possible 100-ft. section of Pennsylvanian reef pay, on the basis of drill-stem tests.

Location is in Labor 27, League 3, Taylor CSL.

Stanolind Completes Dual Winkler Discovery

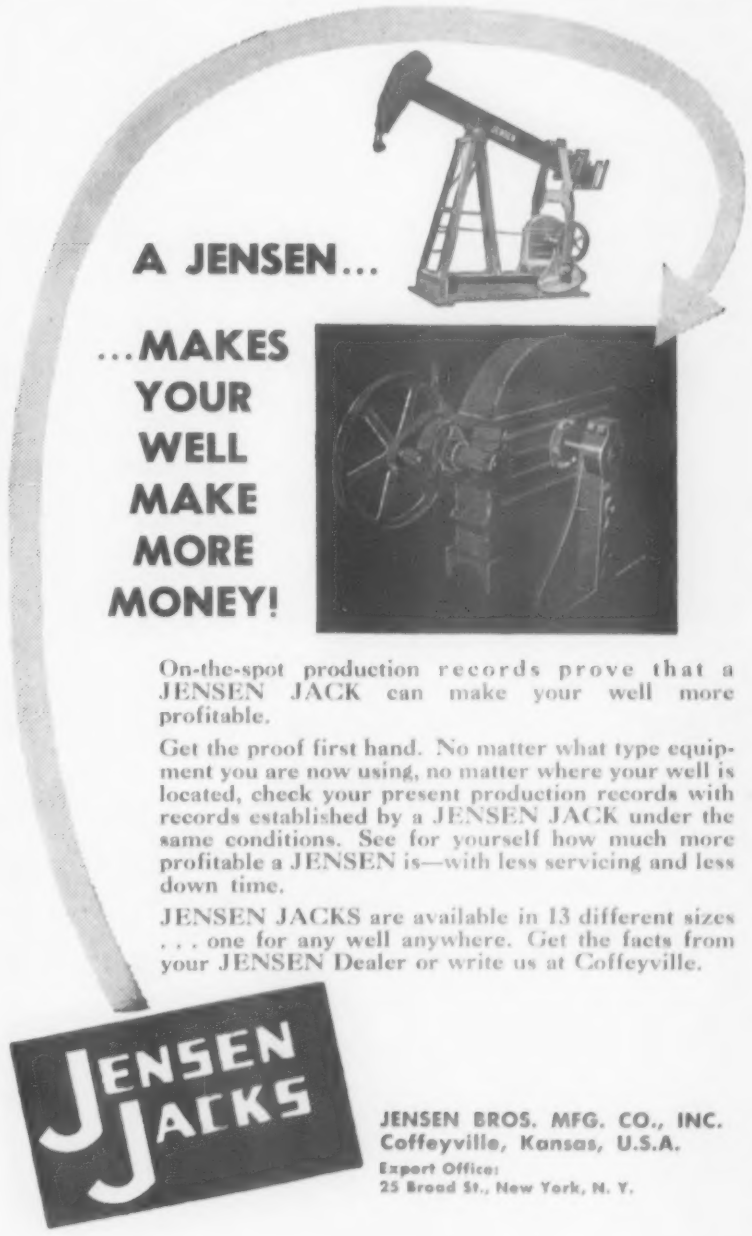
Stanolind Oil & Gas Co. 3-T Hendricks, 3 miles northeast of Wink in Winkler County, has been completed from both the Ellenburger and the Devonian. Location in Section 35, Block 5, PSL, is 1⅝ mile northwest of Ellenburger production and 1 mile west of Devonian oil.

Ellenburger potential at 3-T Hendricks was calculated at 113,000 M.c.f. of gas a day, open flow, plus 960 bbl. of 55° condensate. Perforations were from 11,340-11,400 ft. Gas-liquid ratio was 117,670:1.

Devonian potential was calculated at 74,000 M.c.f. a day, plus 581 bbl. of 54° condensate. Gas-liquid ratio was 127,300:1 and perforations were between 9,110-60 ft.

Pecos County Slated For Deep Wildcats

Phillips Petroleum Co. has made location for an 18,500-ft. wildcat 8 miles east of Fort Stockton. The test is 1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University "EE," and is located in SW NE Section 7, Block 24, University Lands Survey.

British American Oil Producing Co. will drill its 1 White & Baker 14 miles west of Iraan. Location is in Section 32, Block Z, TCRR Survey, 1 mile southwest of Forest Oil Corp. 1 White & Baker, which found the Ellenburger dry in drilling to 8,818 ft. Projected depth at Phillips' test is 9,500 ft.

Martin County . . . BBM Drilling Co., Houston, 1 G. H. Cowden, projected 12,000-ft. wildcat in the southwestern corner of Martin County, found Strawn oil in drill-stem testing at 10,445-98 ft.

On the test, gas surfaced in 5 minutes and oil in 2 hours and 20 minutes. It flowed 8½ bbl. of oil the first hour and 4 bbl. the second hour. Flowing pressure was 420-815 psi., and shut-in pressure reached 4,995 psi. Operators cored ahead.

Location of the wildcat is in Section 31, Block 40, Township 1n, T&P Survey, 12 miles northwest of Midland.

Winkler new pay prospect . . . Sunray Mid-Continent Oil Co. 6 Hill, 22-11-PSL., ⅜ mile southeast of Montoya production in Halley field, Winkler County, flowed gas and distillate while testing the Devonian.

A 3-hour test was run from 9,705-89 ft. Water blanket surfaced in 5 minutes and gas in 6, flowing through ¼-in. choke, at the estimated daily rate of 6,000 M.c.f. Distillate yield was approximately 5 bbl. an hour.

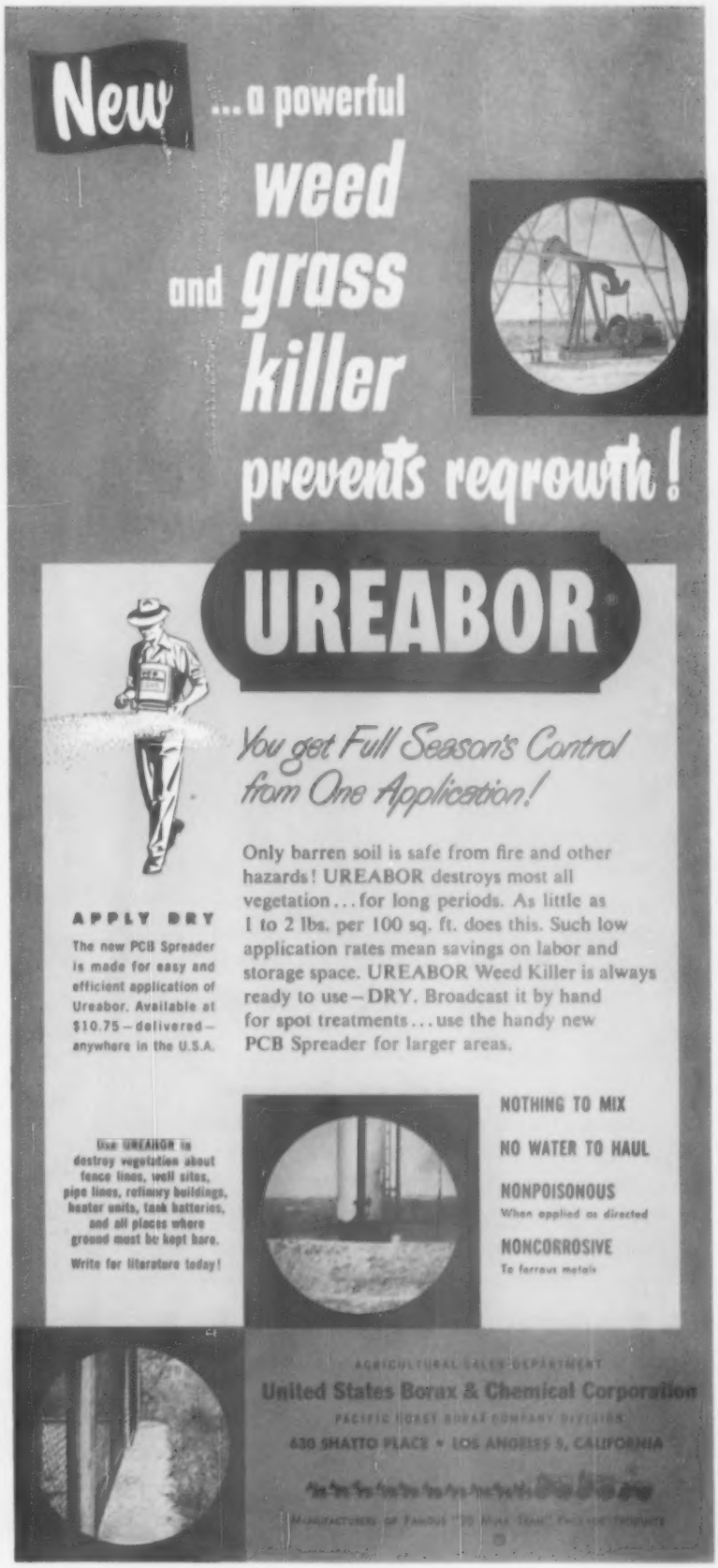
Pay prospect at Seagraves . . . The Yoakum County portion of Seagraves (Siluro-Devonian) field had shows of a new pay in the Strawn at Anderson-Prichard Oil Corp. 1 Strong. A drill-stem test at 11,444-11,538 ft. had gas in 35 minutes; recovered the water blanket cut with oil, and 5,890 ft. of 40° oil. Pressures were not reported.

The well is ¾ mile northeast of the field's Strawn discovery, which was a dual completion, in the Strawn and Devonian. Location is in Section 882, Block D, John H. Gibson Survey.

Loving County prospect . . . Hill & Meeker 1 W. D. Johnson, wildcat 11 miles north of Mentone, reported a flow of gas and a spray of oil in the Delaware sand.

Operators topped the sand at 4,482 ft. and hit gas at 4,486 ft. An increase in gas at 4,499 ft. blew tools up the hole. Gas volume was estimated at 2,000 M.c.f. a day.

Operators killed the well with water. It is a cable-tool test and has no casing in the hole. Location is in Section 48, Block 54, Township 1, T&P Survey.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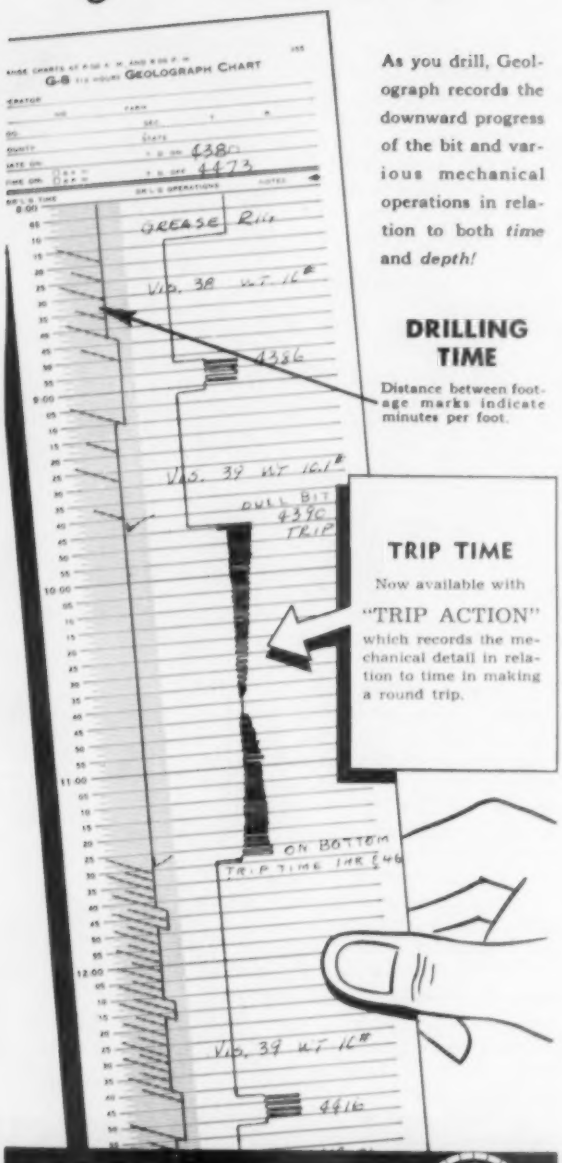

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Shallow Irion Test Completed

Stanolind Oil & Gas Co. has completed a shallow wildcat well for good production in Irion County, West Texas.

Stanolind 1 Ella C. Sugg K, located in Section 69, Block 14, H&TC Survey, flowed 154 bbl. of oil a day through a 22/64-in. choke, from the San Andres, topped at 1,805 ft. The zone was exposed through perforations at 1,890-1,900, ft., with total depth at 4,890 ft. and plugged back total depth at 1,927 ft.

The 1 Sugg K was drilled in an area where there is production currently from the Clearfork at about 5,000 ft.

Irion Review

A new Wolfcamp discovery was indicated and a Wolfcamp wildcat completion was recorded in Irion County.

The indicated discovery is the Southwestern Development Co., Wickett Refining Co., and Tucker Drilling Co. 1 A. A. Sugg, 10 miles northwest of Mertzon. On elevation of 2,155 ft. it drill-stem-tested a zone in the Wolfcamp between 5,532-51 ft. It had gas to surface in 6 minutes, recovered 1,700 ft. of pipeline oil and 121 ft. of heavily oil and gas-cut mud, no water. The bottom-hole flowing pressure registered 80-130 lb., with 30-minute build up of 1,485 lb.

This wildcat spots in Section 1893 of the B. Verbena Survey. It is on a checkerboard farmout lease block from Stanolind covering 3 sections. Operators plan to run pipe and test shortly.

Approximately 4 miles north northwest of that wildcat, Plymouth Oil Co. 1 A. A. Sugg was completed from the Wolfcamp flowing 480 bbl. of oil in 24 hours through a ½-in. choke, tubing pressure 100 lb., casing pressure 40 lb., with a gas-oil ratio of 547:1, oil testing 38.2°. This strike is in Section 14, Block 6, H&TC Survey. It also is on a Stanolind farmout deal. Pay was 5,890-5,912 ft.

SOUTHEAST NEW MEXICO

Lea County Well Opens Pennsylvanian Pool

Sinclair Oil & Gas Co. 1 Seaman Unit, 13-16s-33e, east of Anderson Ranch field and about 4 miles southeast of South Saunders, found the Devonian dry but plugged back to make a big Pennsylvanian well.

Completion potential from 11,219-65 ft. was 612 bbl. of 42.7° oil a day, through 40/48-in. choke. Gas-oil ratio was 1,979:1. The well was drilled to

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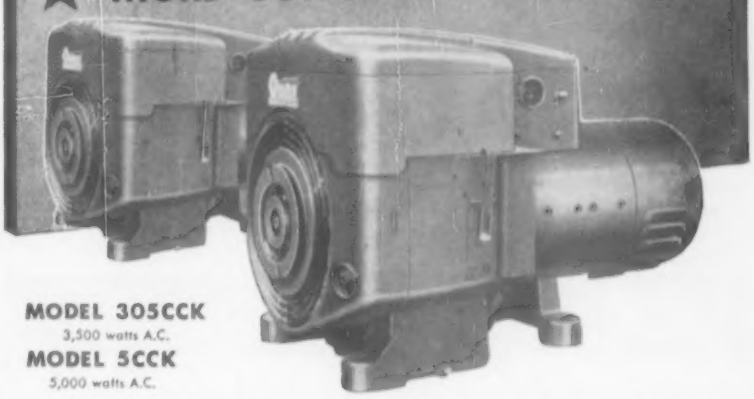

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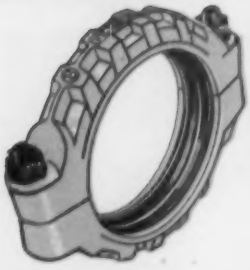

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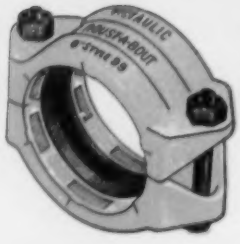

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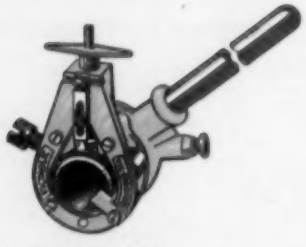

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14,797 ft., then plugged back to 12,758 ft.

In northern Lea County, Jake L. Hamon 1-E State, 35-10s-33e, 10 miles east of Caprock, flowed oil and gas on drill-stem test of the Pennsylvanian at 9,848-55 ft. On ⅝ and 1-in. chokes, gas surfaced in 3 minutes and oil in 9. Changed to ¼-in. top choke, the well tanked 34 bbl. of oil in 1 hour. This well also found water in the Devonian in drilling to 13,250 ft.

SOUTH TEXAS

Sunray Completes Dually Five Victoria Area Wells

Sunray Mid-Continent Oil Co. has completed dually five new producers in Victoria County. One is an indicated gas-discovery well with open-flow potential rating of 150,000,000 cu. ft. per day. It and one other are in the McFaddin area, in the southern part of the county, near the Refugio County line. Two are in the Placedo field. The other is in Keeran field.

The 14-A McFaddin is producing from what appears to be a new gas zone at 6,144-50 ft. Shut-in pressure is 2,225 psi. The well also was completed as an oil producer following perforations at 6,216-19 ft. in what also appears to be a new producing zone. The well flowed at the rate of 96 bbl. of oil per day through 5/32-in. choke from this zone. Gas-oil ratio was 1,600 cu. ft. per barrel. It is in the Jules Vairin Survey.

The 15-A McFaddin, 100 ft. away, was completed as an oil and gas producer with the gas test showing open-flow potential of 30,000,000 cu. ft. per day. It is producing gas from the Sinton zone following perforations at 5,106-18 ft. Shut-in pressure is 1,412 psi. The well also was completed as an oil producer, flowing at the rate of 115 bbl. per day through a 5/32-in. choke after perforations at 5,672-76 ft. in a sand identified as the "5,672-ft. zone." Tubing pressure was 350 psi. and gas-oil ratio 565 cu. ft. per barrel.

At Placedo, the company has completed its 25 Vandenberg & Hill as a dual gas-well. Calculated open-flow potential was 29,000,000 cu. ft. per day from perforations at 4,005-15 ft. in the Catahoula zone. Shut-in pressure is 1,644 psi. In the deeper Sinton zone, the well's calculated open-flow potential was recorded at 4,380,000 cu. ft. daily. Perforations were made at 5,270-72 ft. Shut-in pressure is 1,462 psi. Total depth is 5,381 ft.

The 13 Keeran Ranch, in the Keeran field, was completed as a gas-producer with an open-flow potential calculated at 2,400,000 cu. ft. per day. Perforations were at 6,312-20 ft. Shut-in pres-

sure is 2,375 psi. Calculated open-flow potential of 92,000,000 cu. ft. of gas per day was recorded in a deeper zone at 6,707-11 ft. Total depth is 7,001 ft. Shut-in pressure is 2,540 psi.

No. 4 Agnes West, in Placedo field, was completed with calculated open-flow potential of 2,000,000 cu. ft. of gas per day following perforations at 4,276-82 ft. in the 4,250-ft. zone. A second gas zone, the Sinton, tested for a calculated open-flow potential of 10,000,000 cu. ft. of gas per day with perforations from 5,245-52 ft. Total depth of the hole is 5,340 ft.

SOUTHWEST TEXAS

Jim Hogg County Wildcat Shows for Field Discovery

Discovery of another oil-productive area in northwestern Jim Hogg County is indicated by showings encountered by Daubert & Dolch in their 1 Stroman, a wildcat 12 miles southwest of Hebbronville.

Prospective pay is at 3,696-3,705½ ft., where a 60-minute drill-stem test recovered 160 ft. of pipeline oil and 55 ft. of oil-cut mud. Bottom-hole pressures recorded in the test were 110 psi., flowing, and 918 psi. shut in. Recovery was through ⅜-in. and ¼-in. chokes. Working pressure was 29 psi.

SOUTH LOUISIANA

Two Oil Sands Produce in Bayou Boullion Discovery

Glassell & Glassell have gone back in an old hole, previously "temporarily abandoned," on the northeast flank of the old Bayou Boullion dome, on the St. Martin-Iberville parish line, and established oil production in two sands, both previously unproductive in that sector of the dome.

The well, on the Iberville Parish side of the line, is the operators' 6 Cotton. Its two productive zones are at 8,094-8,101 ft. and 8,125-35 ft. Total depth is 8,499 ft.

The upper zone produced 96 bbl. of 25°-gravity oil per day through 9/64-in. choke with pressure of 300 psi. and gas-oil ratio of 300 cu. ft. per barrel.

The lower zone is good for 144 bbl. of 27°-gravity oil per day through ⅛-in. choke with pressure of 980 psi., and gas-oil ratio of 350 cu. ft. per barrel. No water was indicated.

Humble Adds Discoveries In Southeast Coastal Area

Humble Oil & Refining Co. reports two additional discovery wells in the

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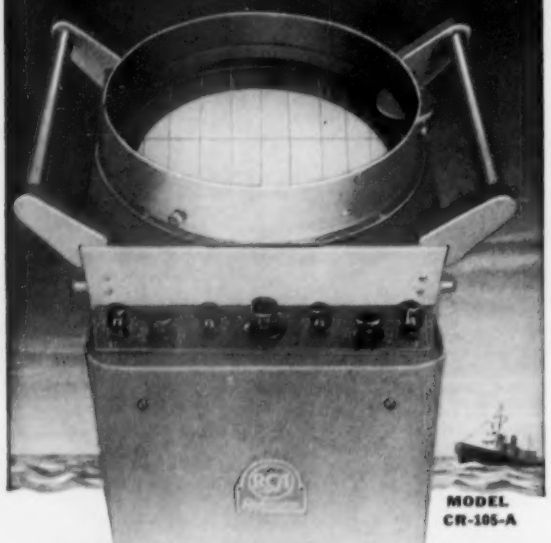

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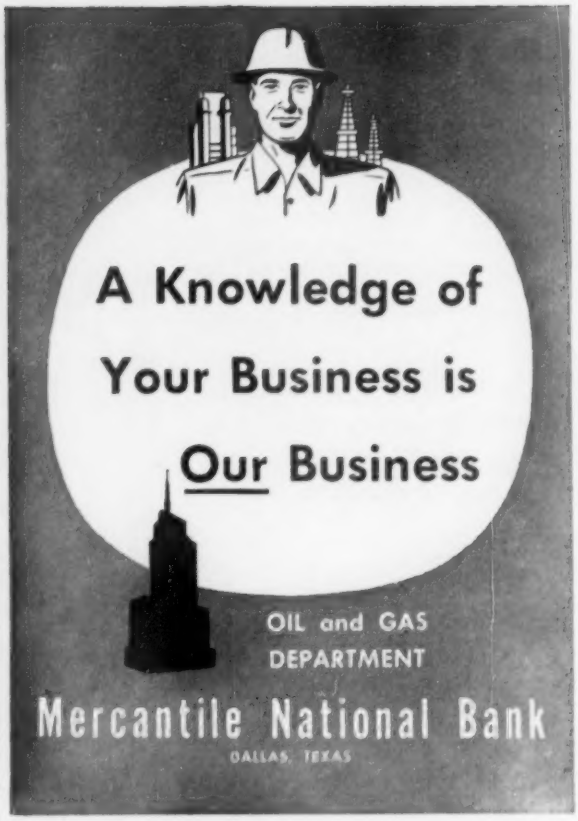

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A WORLD-WIDE SURVEY OF OIL DEPOSITS

their formation • location • and exploitation

This book thoroughly explains the origin, migration and accumulation of petroleum in the subsurface—shows the location of world oil deposits—and describes practical methods for discovering and exploiting them. *All the world's oil lands are reviewed and illustrated in detail*—with facts on their structural and stratigraphic history. Here are helpful maps, graphs, charts—production figures, exploitation techniques—everything necessary for a thorough knowledge of the present and future petroleum situation, and modern methods of exploration.

PETROLEUM GEOLOGY

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This vital handbook logically and systematically covers all the important principles of modern petroleum geology. It explains the origin and accumulation of oil—and illustrates these principles by a detailed discussion of the world's major oilfields. Then a description is given of the ways in which future oilfields may be discovered and exploited.

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southeastern Louisiana coastal district. One is in the Lake Fields area, in western Lafourche Parish, about 8 miles east of Houma. The other is in the Three Bayou area, 2 miles south of Lafitte field, in Jefferson Parish.

The Lake Fields discovery is in the company's 1-Y L.L.&E., in 46-17s-18e, completed with a flow of 66 bbl. of 36.6°-gravity oil and 4,667,000 cu. ft. of gas per day through ⅞-in. choke from a casing perforated interval at 12,426-34 ft. Flow was under pressure of 7,350 psi. The well had been drilled to 12,753 ft.

Location is about 3 miles west of the company's initial well in the area. That well, 1 State Lease 2927-Lake Fields, was completed last July as a potential gas well with pay at 12,249-60 ft. It flowed gas while cleaning, but flow was not gaged, and the well has been standing shut in since then.

In the Three Bayou area, Humble's 1-Z L.L.&E., in Township 18s-24e, flowed 194 bbl. of 30.9°-gravity oil per day through ⅛-in. choke, registering pressure of 2,400 psi. Its Miocene pay is perforated at 10,376-94 ft. in hole drilled to 11,000 ft.

This is the second well in the area, also discovered last July. Initial well was by Richardson & Bass at 1 Humble-State Lease 2707, productive of gas and condensate from perforated interval at 10,411-17 ft.

Venezuelan Geophysical Association Formed

Formation of the Venezuelan Geophysical Association (Asociacion Venezolana Geofisica) has been announced in Caracas by C. G. Schauble, chief seismologist for Sinclair Oil and Gas Co. and acting secretary of the association. Other temporary officers of the new organization are Clifford A. Wachter, chief geophysicist for Venezuelan Atlantic Refining Co., acting legal representative and Joseph A. Keeling, geophysical supervisor for Phillips Petroleum Co., program chairman. All are members of the Society of Exploration Geophysicists, and Schauble said the fifty-one charter members hope to become a local section of S.E.G. as soon as the bylaws have been registered in accordance with Venezuelan law.

Simultaneously it was announced at S.E.G. headquarters in Tulsa, Okla., by Colin Campbell, business manager, that three other local sections are being formed. Geophysicists in the Salt Lake City area have organized under the leadership of T. E. Hobbs, division geophysicist for General Petroleum Corp. Professor G. D. Garland of the University of Alberta is chairman of the organizing committee for a section in Edmonton, Alberta, Canada, and James A. Hafes, geophysicist for British American Petroleum Co., heads the committee to organize a group in Regina, Saskatchewan. Campbell said the affiliations of these new sections will bring the number of S.E.G. local sections to twenty, and efforts will be made to charter the four new sections at the annual meeting of the society October 29 through November 1 in New Orleans.

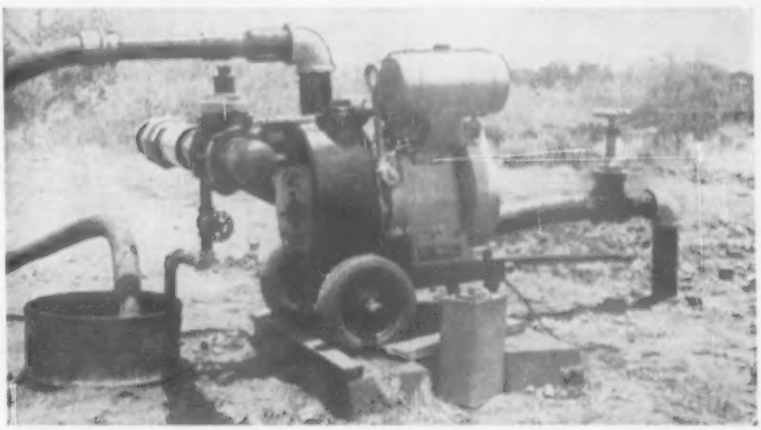
ARK-LA-TEX

EAST TEXAS

Discovery Completed in Northeastern Smith County

Warren Petroleum Corp. 1 J. N. Starnes, 4 miles northeast of Starville in Smith County, has been completed as a Pettet limestone discovery. Location is in the John W. Allen Survey.

Flowing potential through ¼-in. choke was 134 bbl. of oil a day. Per-



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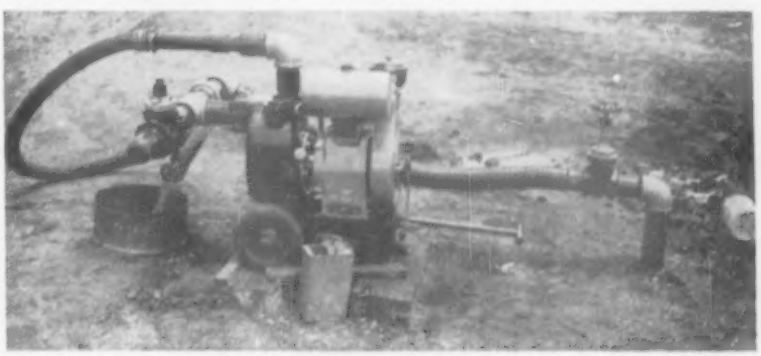
• These pumps are especially built for oil field service in a large variety of sizes and models. Each Dual Primer is a compact, ready-to-run unit that can be used for either suction lift or booster pumping. Write for latest Pump Bulletin.

CONSTRUCTION MACHINERY COMPANY, Waterloo, Iowa

Pictured above & below, CMC Model 37-N on a typical oil field gathering operation.



For fishing, testing and core-drilling strings . . .

. . . plus Safety Joint protection!

THE SHAFFER OIL-SEALED JAR SAFETY JOINT

The Shaffer Oil-Sealed Jar Safety Joint is the only tool that combines a choice of *jar-up* and *releasing* actions, both under complete control of the operator at all times. What's more, all operating parts are sealed in a chamber filled with clean oil, fully protected against mud, sand and corrosive fluids.

The sealed-in-oil protection not only safeguards against abrasion and corrosion, and minimizes pressure differentials on packing elements, but also insures constant operating characteristics at all depths. This makes the tool ideal for fishing, testing and similar strings where light connections and equipment are used!

Jar-Up Action

JARRING ACTION IS AUTOMATIC—simply raise the drill string until tension equals the pre-set tripping load, whereupon a sharp up blow is struck. Lowering the tool automatically re-sets the tripping mechanism for another blow—and repeated blows can be struck as fast as the string can be raised and lowered.

Releasing Action

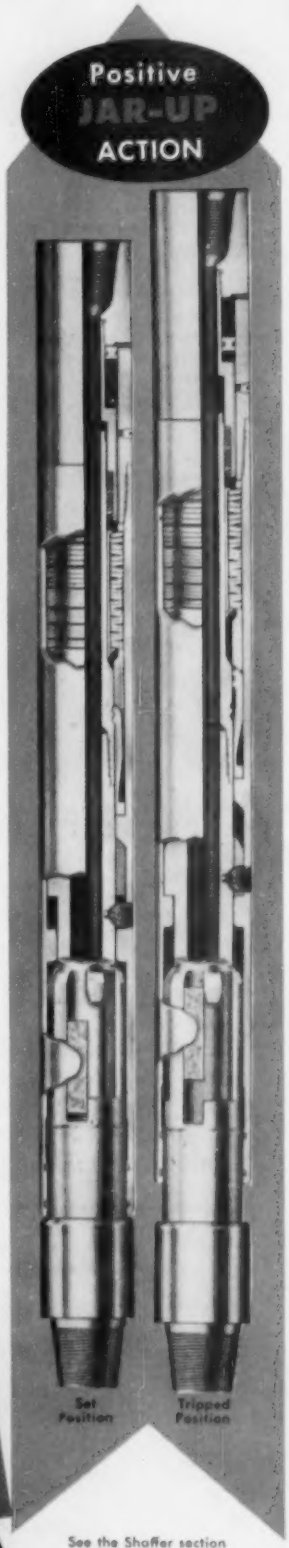
ONLY STRAIGHT PULL is necessary to operate the tool—no torque or other secondary operations to affect the light connections commonly used in fishing, testing and coring strings.

TO RELEASE, in the event the fish or stuck string cannot be loosened, simply trip the tool and apply reverse torque as the string is slowly lowered. Only one-sixth turn of the drive keys rotates them into an unlocking slot whereupon raising the string allows the parts to unlock.

AND NOTE THIS—not only does the tool transmit full torque loads in *either* direction, but no threads are used in the releasing mechanism. Therefore there's no risk of torque over-tightening the tool—nor can reverse rotation accidentally release it.

Also, force of the blow is absorbed by integral knocker heads—not by easily damaged drive keys or threads. The tool is designed for *sustained* jarring operations. And since it does not depend upon friction for its tripping action, the Jar Safety Joint always operates with the same pre-set action. Light strings are not subjected to unpredictable loads!

Free 8 page booklet gives many other facts about the Shaffer Oil-Sealed Jar Safety Joint. Write for it—or ask your nearest Shaffer representative.



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33 years

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forations were from 8,251-55 ft., and gas-oil ratio was 440:1.

The new well is 2 miles northwest of Friendship community and about the same distance southwest of a small Pettit pumper in the S. J. Lott Survey, drilled by Bobby Manziel.

Navarro County . . . The Texas Co. has staked location for 1 J. N. Edens 2½ miles north of Navarro, in James Smith Survey, A-726. Projected depth of 9,500 ft. is expected to explore both the Pettet and Travis Peak sections. Location is 2 miles west of shallow production in the old Powell field.

Cass County . . . Wiggins Brothers, Inc. 1 Speer, wildcat 1½ miles northeast of Kildare and 3½ miles northeast of production in Kildare field, developed salt water with no shows on a test of the Lower Pettet. The section tested was around 6,900-30 ft. Drilling continued after the test. Location is in the George Gordon Survey, A-399.

ARKANSAS

Pipe Recovery Set at Second Arkansas Wildcat

Jerry Maiatico and George P. Lemm have landed casing at 4,171 ft. at 2 Townsend-Arkansas Game & Fish Commission in 7-5s-6w, 4½ miles northeast of Cornerstone and 16½ miles northeast of Pine Bluff in Arkansas County, southeast-central Arkansas.

The operators reportedly found pay zone in the well at 4,100-71 ft. Top of Paleozoic rocks was at 4,170 ft. This Wabbaseka Bayou area wildcat is the second in the area. The 1 Townsend, 18-5s-6w, was bottomed at 3,912 ft. and cased to 1,950 ft. They reportedly found oil shows in four silty sand of the Wilcox at 1,614-1,779 ft. The second wildcat also has shows in this interval. Discovery at either of these wildcats would open production in an oil-barren province of Arkansas.

Pulaski County Wildcat Rigging Up

Memphis Equipment Co. is drilling 1 Davis in SW NW NE 4-4n-11w, 5½ miles northeast of Cato and 15 miles northeast of North Little Rock, northern Pulaski County in the central part of the state. This well will go to 4,000 ft., or to the top of the Paleozoics if need be.

Moreland Well Flows Additional Gas

Carter Oil Co. 1 Chronister in C SE NE SW 3-8n-19w, Moreland field, Hope County, northwest-central Arkan-

sas, flowed an estimated 3,000 M.c.f. of gas per day in sand at 4,464 ft. Gas at this depth is a new-pay discovery for the field, a basal Pennsylvanian producer.

Successful Wildcats

ALBERTA

Gulf-California-Standard-Husky-Phillips 8 Davidson, LSD 8, 9-44-1w5. D3 gas well. TD 7,928 ft.

Sharples Manawah Lake 14-18, LSD 14, 18-56-25w4. Basal Quartz gas well. TD 4,502 ft.

NEBRASKA

Cheyenne County: Shell Oil Co. 1 State, C NE SE 16-12n-53w. IP 1,666 M.c.f. of gas per day, "J" sand discovery, new field. TD 5,733 ft.

Morrill County: McDaniel Drilling Co. 1-A Stark, C NW SE 3-18n-52w. IPP 60 BOPD, "J" sand discovery, new field. TD 4,846 ft.

UTAH

San Juan County: Shell 1 North Desert Creek, C SE SE 12-41s-23e. IPF 1,400 BOPD, 48/64-in. choke, Paradox discovery, new field in Paradox basin. TD 5,624 ft. Paradox.

COLORADO

Sedgwick County: Texota Oil Co. 1 Ricker, C SE NE 14-9n-46w. IP 2,500 M.c.f. of gas per day, "D" sand gas discovery, new field. TD 3,882 ft. Skull Creek.

Washington County: Sun Oil Co. 1 Peterson, C NW SW 15-3s-54w. IPP 45 BOPD, "J" sand discovery, new field. TD 4,966 ft. Skull Creek.

CALIFORNIA

Colusa County: Humble Oil & Refining Co. B-1 O. P. Davis, NW SW 14-15n-1w, 1,812 M.c.f. daily, perfs. 1,480-1,505 ft., TD 3,600 ft. (New gas field discovery near Meridian.)

Kern County: Richfield Oil Corp. 14-27 ROC-KCL G, 195 BOPD, 37.5° gravity, 13/64-in. choke, 0.4 per cent cut, perfs. 8,731-8,800 ft. and 8,831-63 ft., TD 10,940 ft. (Deeper pool discovery on east edge of Wheeler Ridge field.)

Kern County: Richfield Oil Corp. 16-30 Richfield-Mohawk-Wheeler Ridge Comm., NW SW 30-11n-19w, 118 BOPD, 27.5° gravity, 18 per cent cut, 32/64-in. choke, perfs. 5,373-5,604 ft. and 5,648-5,904 ft., TD 9,777 ft. (New pool discovery ½-mile northeast of Windgap area of Wheeler Ridge field.)

KENTUCKY

Hopkins County: H. L. Browning 1 Lutz, NE NE SW 7-K-24. IPP 29 BOPD, Jackson sand 2,608-15 ft.; Lower O'Hara 2,955-57 ft. TD 3,139 ft. (Discovery of Manitou pool.)

SOUTHWEST TEXAS

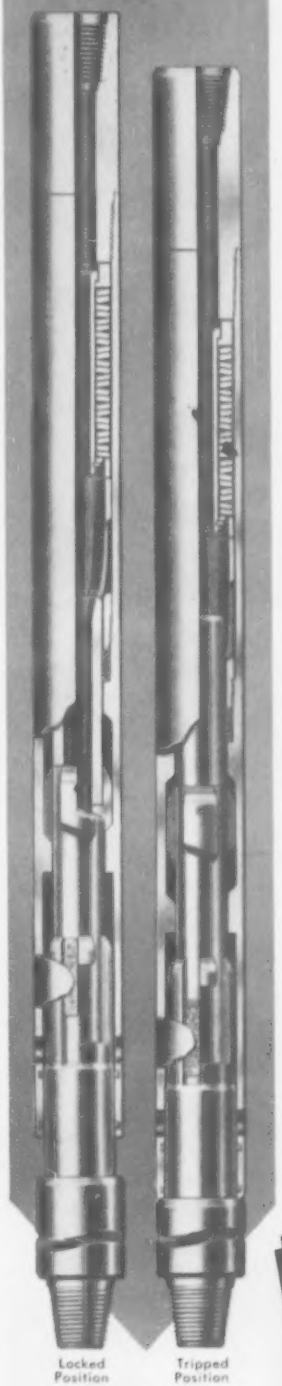
Dimmit County: Michel T. Halbouty 1 Shook et al I&GN Sur., A-898 (8 miles SW of Carrizo Springs). IP 91/42 BOPD, 7/32-in., 36.4°, perforated 2,922-26 ft. (Olmos sand). TD 4,633 ft. (New field.)

Jim Wells County: Bridwell Oil Co. 2-A Hoffhines, William Parks Sur. 29, A-341. IP 10,000 M.c.f. daily, ¾-in., perforated 1,863-68 ft. TD 4,023 ft. (Workover—originally completed May 6, 1952, as dry. Opens new field.)

Wilson County: Security Drilling Co. and Duggar Holmes 1-B Hardy, J. Reynolds Sur. IP 133.2 BOPD, 9/64-in., 32°, open

For running in the drill string . . .

Positive JAR-DOWN ACTION ...plus Safety Joint protection!



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THE SHAFFER-WAGGENER BUMPER SAFETY JOINT

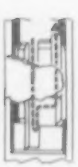
There is no other tool like the Shaffer-Waggener Bumper Safety Joint. It combines—in ONE tool—a choice of *jar-down* and *releasing* actions, both under complete control of the operator. What's more, the tool is so rugged it is run as part of the drill string to protect against stuck pipe.

In actual well service it has operated easily at depths below 18,000 feet, and has given no operating problems even in directionally-drilled wells with extreme slant.

Jar-Down Action

▶ **RUN IT IN THE DRILL STRING**—It is specifically designed to withstand the continuous vibration and heavy torque loads of today's drilling operations.

▶ **TO JAR DOWN** whenever the drill pipe threatens to stick—or to drive drill collars out of keyseats and to free "balled-up" bits—simply slack off weight equivalent to about 2,000 feet of drill pipe onto the tool. This releases the tripping mechanism, automatically striking a sharp down blow. Raising the string automatically re-sets the tool for another blow—and blows can be struck repeatedly as fast as the string can be raised and lowered. And no torque or twisting strains are placed in string!


Releasing Action

▶ **TO RELEASE,** in the event jarring will not loosen the stuck string, simply trip the tool and apply reverse torque as the string is slowly raised. Only one-sixth turn of the tool rotates the drive keys into unlocking slots so that complete release is effected by continuing to raise the string.

ANOTHER ADVANTAGE—the tool transmits full torque loads in *either* direction through three rugged drive keys—not through easily-damaged threads. It is the strongest joint in the string—not the weakest, as with conventional safety joints.

Also, the tool can be re-connected again by simply lowering the top portion over the lower portion and reversing the releasing action. It is ideal for use in fishing strings!

Free 8 page bulletin gives the full story on the Shaffer-Waggener Bumper Safety Joint. Write for it—or ask your nearest Shaffer representative.

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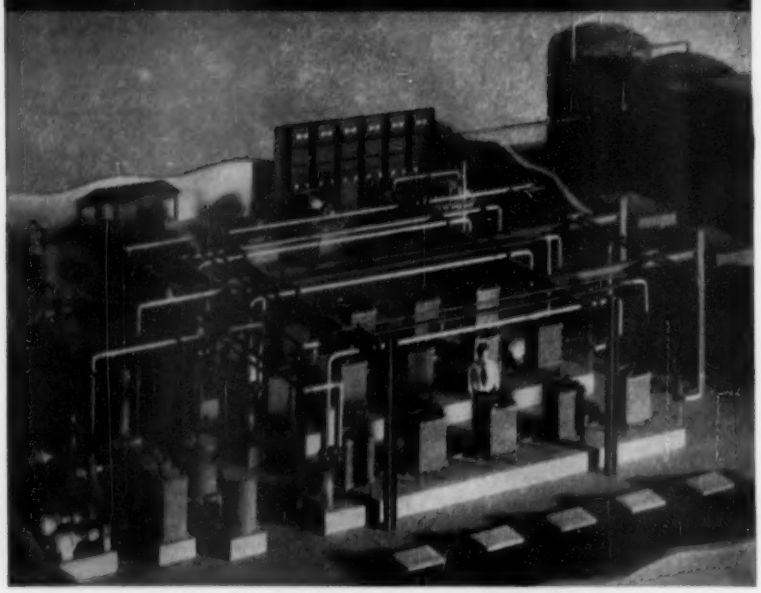
...FROM A BRACKISH WELL



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Well water chemical analysis . . . . . 3100 ppm dissolved solids
Product water chemical analysis . . . . . 450 ppm
Electric energy consumption . . . . . 15 kwh per 1000 gallons
Daily capacity—present . . . . . 28,800 gallons per day
Daily capacity—final . . . . . 86,400 gallons per day

The electric membrane plants remove salt, hardness, alkalinity, gypsum, epsom salts, nitrate and fluoride from natural waters.

They operate continuously, automatically, economically.

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hole 4,885-4,975 ft. (Austin-chalk discovery-well in East Floresville field.)

TEXAS GULF COAST

Brazoria County: The Texas Co. 1 Minchen-Jackson Oil Unit, William Roberts Sur., A-124 (1½ miles SW of Blue Lake field). IPP 13 BOPD, 36.4°, perforations 9,168-80 ft. TD 11,445 ft. (Discovery-well West Blue Lake field.)

Chambers County: Wesley West L Stanolind, C. Gilbertson Sur., A-566. IP 106.66 BOPD, 3/32-in., 35.5°, perforations 8,277-81 ft., and (dual completion) 123.04 BOPD, 7/64-in., 44.5°, perforations 8,987-91 ft. TD 10,502 ft. (Second well and new pays in Walla-Boyt field.)

Galveston County: Hassie Hunt Trust I Teitmeyer et al Unit, A. Julia Sur., A-130, Lot 60. IP 312 BOPD, ¼-in., 46.1°, perforations 10,784-88 ft. (Banfield sand) and (dual completion) 275 BOPD, ¼-in., 46.9°, perforations 10,928-33 ft. (Schenck sand). TD 11,050 ft. (New pay—Banfield sand—in Alta Loma field.)

Kenedy County: The Texas Co. 11 Yturria, NCT-1, San Juan de Carricitos Grant, A-8 (11 miles northeast of Raymondville). IP 2,230 M.c.f. daily, spray condensate, $\frac{7}{16}$-in., perforations 8,430-44 ft. TD 8,514 ft. (New field.)

KANSAS

Barber County: South Blunk pool was opened by Orville Parker and Cities Service Oil Co. at 1 Sternberger, NE NE SW 1-35s-14w. IP 6,000 M.c.f. of gas per day, Mississippi. TD 4,876 ft.

Elsea pool was opened at Honaker-Davis 1 Elsea, SW SW SE 27-32s-14w. IP 25,000 M.c.f. of gas per day from Mississippi. TD 5,230 ft.

McGuire pool was opened at Mull Drilling Co. 1 McGuire, SE SE NW 24-32s-11w. IP 27,100 M.c.f. of gas per day, Mississippi. TD 4,428 ft.

Platt pool was opened at Republic Natural Gas Co. 1 Platt, C NW NW 28-33s-15w. Completing in Cherokee sand. TD 5,450 ft.

Barton County: West Workman pool was opened at Cook & Galloway 1 Ajderson, SW NW NW 28-20s-12w. IP 73 BOPD, Arbuckle. TD 3,450 ft.

Butler County: Southwest Pontiac pool was opened at Twin Drilling Co. 1 Jones, SE SE SW 23-26s-6e. (OWWO). IP 8 BOPD, Mississippi. TD 3,305 ft.

Comanche County: Boisseau pool was opened and abandoned at NCRA and Murfin 1 Boisseau, NW NW NW 22-31s-18w. Dry hole after testing in Marmaton. TD 5,265 ft.

Decatur County: North Warner pool was opened at Sauvage & Dunn 1 Kilzer, SE SE SE 2-1s-27w. Completing in Lansing. TD 3,500 ft.

Elk County: Roby pool was opened at Phillips Petroleum Co. 1 Roby, SW SW SW 20-28s-9e. IP 32 BOPD, Arbuckle. TD 2,876 ft.

Ellis County: Potter pool was opened at Franco-Central 1 Potter, SW NW SE 20-11s-16w. Completing in Arbuckle. TD 3,316 ft.

West Engel pool was opened at Tomlinson & Kathol 1 Engel SW SW NW 33-14s-18w. Completing in Lansing at old well work over. TD 3,704 ft.

North Leiker pool opened at Don Pratt 1 Leiker "A," SE SE NW 2-15s-18w. Completing in Arbuckle. TD 3,606 ft.

North pool was opened at Bon Pratt & Armer 1 North, SE SW SW 20-15s-20w. IP 202 BOPD, conglomerate. TD 3,980 ft.

Greenwood County: Mignot pool was opened at Inland Oil Co. 1 Mignot, NW NW

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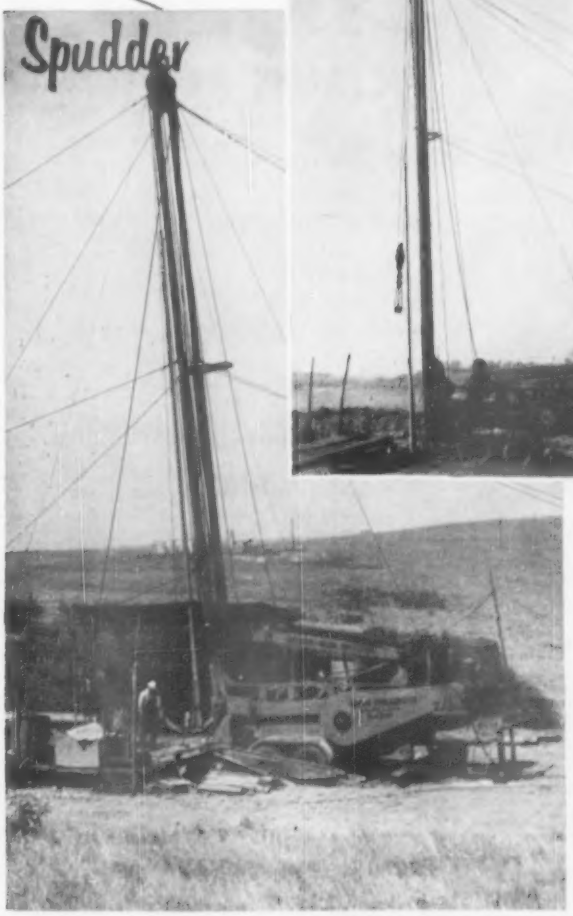
WALKER-NEER S-43 SPUDDER



The S-43 is three rigs in one—yet costs no more than conventional spudders.

- Outclasses ALL competitive spudders in top-to-bottom drilling to 3000 feet.
- Handles any job to 4000 feet that any well servicing unit will handle . . . *just as fast and just as efficiently.*
- Can be built as a combination spudder and rotary, or easily converted to such, by simply adding one countershaft, clutch, and sprocket to drive the rotary table.
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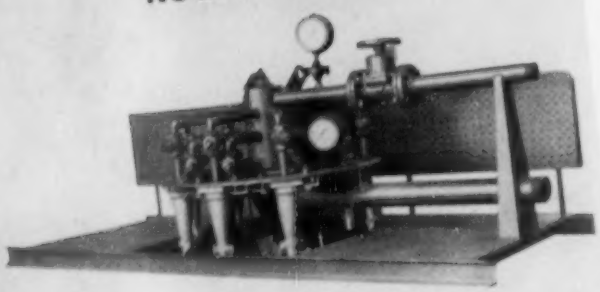
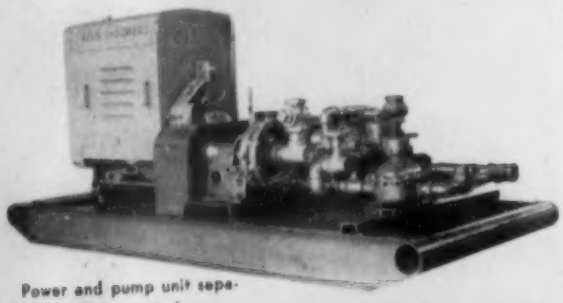


Liquid Cyclone unit with no moving parts. Catwalk in raised position.



Power and pump unit separately skid mounted.

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NW 9-22s-11e. IP 5 BOPD, Bartlesville sand. TD 1,974 ft.

Kiowa County: Kane pool was opened at Gramehart-Miller Kane Ranch, NE NE NE 12-30s-18w. Completing in Mississippi. TD 5,014 ft.

Marion County: South Beauty pool was opened at John Hannah 2 Batchelor, NW SW SE 3-19s-4e. Completing in Misssissippi. TD 2,322 ft.

Meade County: Plains pool was opened at CRA and Wakefield 1 Baty "A," C SW SW 17-32s-30w. Completing in Morrow sand. TD 5,772 ft.

South Singley pool was opened at The Texas Co. 1 Fox, C SE NE 32-33s-29w. Completing in the Morrow sand at TD 5,894 ft.

Pawnee County: Godfrey pool was opened at Welch & Olsson 1 Godfrey, NE NE SW 12-22s-18w. Completing in conglomerate. TD 4,200 ft.

Rice County: Humphreys pool was opened at Sterling Drilling Co. 1 Humphreys, SE SE SW 3-21s-8w. IP 3,210 M.c.f. of gas per day. Conglomerate. TD 3,695 ft. OWWO.

Rush County: Southwest Webs pool was opened at Natural 1 Williams "B," NW NW SW 16-19s-20w. IP 59 BOPD, Cherokee sand. TD 4,395 ft.

Sedgwick County: Northeast Chambers pool was opened at Pickrell Drilling Co. 1 Struthers "A," NE NE SW 2-29s-2w. Completing in Mississippi. TD 3,662 ft.

North Latta pool was opened at Beardmore Drilling Co. 1 Lauterback, SE SE SW 33-29s-2w. Completing in Lansing. TD 3,684 ft.

Sheridan County: Hoxie pool was opened at Heathman-Seeligson 1 Decker "A," NW NW NW 6-9s-28w. IP 581 BOPD, Toronto. TD 4,411 ft.

Stafford County: Northwest Farmington pool was opened at Anschutz Drilling Co. 1 Ackerman, NW NW SW 29-24s-15w. Completing in Lansing. TD 4,505 ft.

South Knoche pool was opened at Anschutz 1 Byer, NW NW SE 17-24s-12w. Completing in Viola. TD 4,130 ft.

Northwest Shepherd pool was opened at Petroleum, Inc., 1 Erickson "B," NE SW SE 8-22s-11w. Completing in Simpson. TD 3,582 ft.

Wallace County: Sexson pool was opened at Skelly Oil Co. 1 Sexson, NW NE SW 19-13s-42w. IP 14,000 M.c.f. of gas per day, Morrow sand. TD 5,588 ft.

Woodson County: Gordon pool was opened at Joe Phillips 1 Gordeon, C NW SE 13-24s-15e. IP 1,500 M.c.f. of gas per day, Squirrel sand. TD 1,096 ft.

EAST TEXAS

Anderson County: Gibson Drilling Co. 1 Huddleston, W. R. Wilson Sur., A-66, 1 mi. W of West Slocum field. IP 213 BOPD, 12/64-in., TP 700 psi., 45°, GOR 859, Woodbine 5,534-40 ft. TD 5,800 ft., elev. 468 ft.

WEST TEXAS

Dawson County: Camp Oil Co. 1 Emma Blue, 25-34-T4N-T&P, 6 mi. N Ackerly. IP 237 BOPD, 16/64-in., TP 400 psi., GOR 563, 40°, Canyon reef 9,086-92 ft. TD 9,171 ft., ground elev. 2,838 ft.

Ector County: Gulf Oil Corp. 789 Goldsmith, 19-44-T1S-T&P, 5 mi. SW Goldsmith. IP 1,071 BOPD, ½-in., TP 340 psi., GOR 812, 34.9°, Tubb perforations 6,220-6,360 ft. TD 10,785 ft., PB 6,390 ft. Ground elev. 3,221 ft.

Glasscock County: Advance Petroleum Co. 1 Howard, 29-35-T5S-T&P, 21 mi. SW Garden City. IP 436 BOPD, 30/64-in., TP 175 psi., GOR 865, 38°, lower Spraberry 7,350-57 ft. TD 7,389 ft.

Terry County: The Texas Co. 1 Allean C. Black, 123-D11-D&SE, 5 mi. SW Gomez. IP 725 BOPD, 28/64-in., TP 390 psi., GOR zero, 35.7°, Siluro-Devonian pay 12,770 ft., elev. 3,402 ft. TD 12,800 ft.

Tom Green County: Dykes Drilling Co. 1 Duff, Sec. 1187, GC&SF Sur., 10 mi. S Christoval. IPP 37 BOPD, 35°, GOR 100, Strawn pay 6,884 ft. TD 7,201 ft.

WEST VIRGINIA

Tucker County: Licking district: Hope Natural Gas Co. et al 9854 Wm. Blair, elevation 1,816 ft., 1,400,000 cu. ft. gas after fracture, (deepened from 4,866 ft.). Oriskany sand 4,761 ft. Second gas pay 4,872-4,875 ft. TD 5,019 ft.

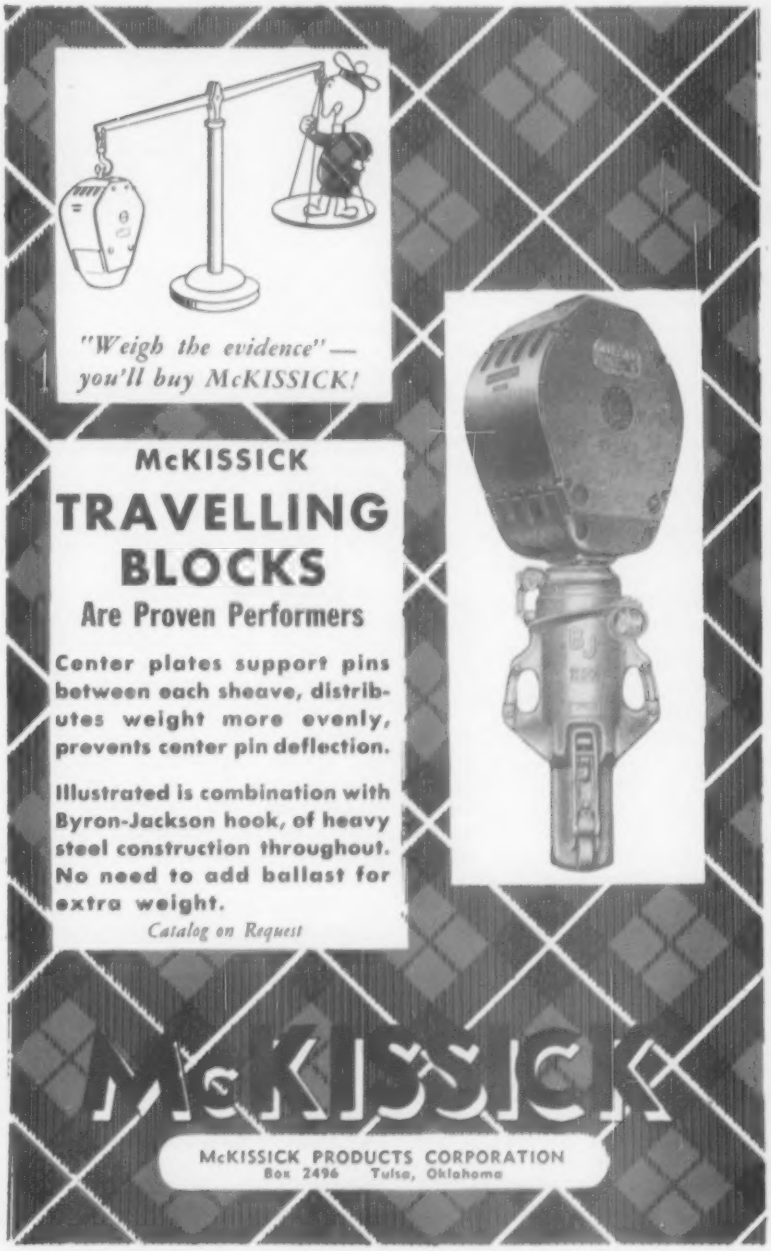
TEXAS PANHANDLE

Hansford County: Humble Oil & Refining Co. 1 Hansford Gas Unit No. 9, C NW SE 45-110, H&TC Sur. IPF 8 BDPD, 2,600 M.c.f. of gas per day, 64°, Morrow sand 7,118-24 ft. TD 7,680 ft. (gas-distillate discovery).

OKLAHOMA

Beaver County: Cabot Carbon Corp. 1 Barby "D," SE NW 25-4n-26eCM. IP 4,162 M.c.f. of gas per day, Virgil-Lovell sand (Penn.) 4,871-94 ft. TD 7,200 ft. (Gas discovery in Hugoton).

Caddo County: Sinclair Oil & Gas Co. and Cities Service Oil Co. 1 Susie, 6 miles east of Southwest Carnegie in C NW SE 1-6n-13w. IPF 708 BOPD, first and second Bromide sands 8,711-8,902 ft. 607 M.c.f. of gas per day, 37.5° gravity oil, 18/64-in. choke. TD 9,622 ft. (Oil discovery).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Groenewold still an optimist . . .

. . . Future Bright for Drilling

MAUD, Okla., in 1929 wasn't exactly a honeymooners' paradise—especially for a young lady from a socially prominent family used to the niceties of life in Denver.

But that's where Bernard E. Groenewold, a strapping young engineer, brought Gertrude Oehlmann Groenewold to start housekeeping after their marriage.

Maud was an oil boom town—the Seminole field was at its roisterous height. Oil-field roustabouts, engineers, leasemen, supply folks, and general hangers-on overran the town. Poor housing was scarce, good housing even scarcer. Prices were high. And there always was either dust or mud.

Groenewold 27 years later laughs and jokes about life at Maud. There's good reason: He is a big, hearty fellow who looks on the brighter side. Then too he didn't keep his bride too long at Maud and life since then has served him pretty well.

Groenewold still describes the Maud days as "high-powered living." His explanation: "We were lucky to get into a newly built apartment with one of the few private baths in town." His description of the town's lone paved street: "It was the only mudhole in Oklahoma with a cement bottom."

Better things . . . Groenewold has come far since the days at Maud.

Only last week he was promoted to president of Exploration Drilling & Oil Co. of Tulsa. He had been vice president and general manager for several years. In his new job he succeeds Bailie W. Vinson, who was elevated to chairman of the board.

Groenewold is a native of Toledo, Ohio, where his father was a general contractor. He had reached Maud by way of Massachusetts Institute of Technology, Denver, and New York City.

At M.I.T. he distinguished himself as a heavyweight member of the freshman boxing team until his doctor advised him to stick to his studies. He was graduated with a chemical engineering degree in 1925 and immediately joined Cities Service Co. in Denver as a junior engineer.

Groenewold in Denver did all the onerous jobs that generally fall the lot of fledgling engineers—with one exception. He met Cyrus Oehlmann, Cities Service executive in the Rockies, and his family, especially his daughter, Gertrude. A romance began but had to be continued by long distance. The young engineer was transferred to New York

in 1926 and the next year joined National Supply Co. in Toledo. He was transferred to the Seminole field 2 years later and finally persuaded Miss Oehlmann to take the marriage step and live at Maud.

Groenewold served National as division engineer in Tulsa and Houston until 1940 when he joined Bethlehem Supply Co. in Tulsa as manager of engineering sales. He came to Exploration Drilling in 1948 as chief engineer.

Oil grows up . . . In these years, Groenewold saw the oil industry make some of its greatest technical strides. He played a part in the drilling and development of the Mid-Continent, Gulf Coast, and West Texas.

He still vividly remembers a "fishing" job on one of the first offshore wells in 1938. He had to help "fish" National equipment out of the water after a hurricane bowled over a Superior Oil Co. derrick and platform in a Louisiana bay.

Groenewold thinks the drilling and exploration segment of the oil industry has a bright future.

"The drilling business today is about where the production branch was 30 years ago," he says. "In fact we're 30 years behind, and the greatest technical advancements are still to come.

"A young engineer with a broad technical background, business judgment, and common sense can still go far."

Groenewold is a director of the American Association of Oilwell Drilling Contractors and is chairman of the organization's Tool Pusher's Manual Committee. He directed the development of a 350-page manual which took 4 years to compile. The material was designed to be an encyclopedia of technical information and procedures to help responsible field personnel in the drilling industry.

In between traveling about 150,000 miles a year on company business, Groenewold finds time to enjoy a few hobbies. He collects steins and U. S. stamps, likes woodworking and motion picture photography. His mean interest still is his family and the career of his son, Bernard Cyrus Groenewold, a geology student at the University of Oklahoma.

Personals

George R. Kinter has been appointed assistant manager of Tidewater Oil Co.'s gas utilization department in Houston. **Arthur M. Mouser** has been transferred from Tulsa to Houston as divisional petroleum engineer. Mouser replaces **J. E. Bailey,** who has been named assistant to the production manager. **J. M. Tharp, Jr.,** district superintendent of offshore operations in Houston, has been transferred to the company's western division. He will be succeeded in Houston by **George H. Truran.**

Dave Campbell, engineer with Standard Oil Co. of California, has been transferred from Taft, Calif., to Coalinga, Calif.

Paul K. Kopper, geologist with Conorada Petroleum Corp. in British Somaliland, has joined Continental Oil Co. in Salt Lake City.

William M. Raimer, reservoir engineer with Sinclair Oil & Gas Co. in Tulsa, has been transferred to Gainesville, Tex., as petroleum engineer.

Francis J. Barker, senior engineer for Union Oil Co. of California in Bakersfield, Calif., has been promoted to district superintendent in Union's production department at Coalinga, Calif.

W. Fred Schmid, geologist for Sinclair Oil & Gas Co., has been transferred from Lindsay, Okla., to Oklahoma City.

Dr. Gregory W. Webb, geologist with Standard Oil Co. of California in Bakersfield, Calif., has joined the geology faculty of Amherst College in Amherst, Mass.

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McCullough Tracer Log Shows Where to Shut Off 300 B/D Water Entry

The accuracy of McCullough's Radiation Well Logger and the value of McCullough isotope injection methods and tracer logging techniques were recently demonstrated in this Rocky Mountain area well.

The well was originally completed as a good oil well. Shortly after completion water broke in and killed the oil production. Rate of water entry was 300 barrels per day. At the producing horizon 5½" O.D. 14.5 lb. casing had been cemented in 9" hole.

McCullough was called to run their Isotope Injector and logging instrument to attempt to locate the point of water entry. A channel was discovered in the cement behind the casing. Also, there was a channel from one interval of the sand, which was the producing horizon, to another interval which was water bearing. Depth of operation was between 4650' and 5072'.

The well was squeezed and is once again a good commercial producer. This tracer job required only 5½ hours to complete. Locating a point of water entry is often difficult if not impossible to do. In this instance, well conditions and the efficiency of McCullough instruments permitted the successful completion of the job.

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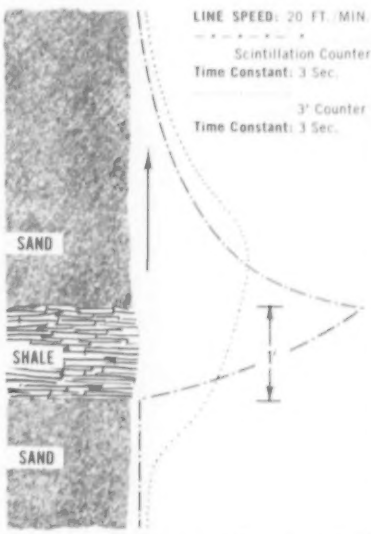
Fifteen Borderline Wells Turned Into Profitable Producers

Precision Logging with McCullough's Scintillation Counter and Pin-Point Accuracy in Perforating Resulted in 645 B/D Increase in Production

Extra profits from only two days of increased production more than paid the entire costs of all McCullough Radiation Well Logging and Perforating Services according to the operator of this work-over project.

This company was producing fifteen borderline wells whose average production was 7 barrels of oil per well per day. Depths ranged from 3000 to 6000 feet. All wells had been electrically logged at the time of their original completion.



Illustrating the accurate definition obtained by McCullough's scintillation counter. Above shows the ideal response that would be obtained in measuring a thin bed with the scintillation counter and with a long counter. Note that, because of its short length, the scintillation counter exactly defines the boundaries of the thin bed, whereas the reading of the longer counter is an average of the radiation over the entire length of the counter.

Wells were re-logged with McCullough's Radiation Well Logger and it was found that there was as much as 17 feet of difference between the measurements obtained by the two types of logs. Also, several new zones were located that had been missed by the other logs.

Depending upon which perforating process would prove most effective for individual well conditions, the fifteen wells were shot with either McCullough M-3 Bullet Guns or Glass Jet Perforators.

Shooting the new zones disclosed by McCullough Logs and reperforating the old zones with McCullough depth corrections increased production to an average of 50 barrels of oil per day per well—a total gain of 645 barrels for the 15 wells. This was a highly profitable project.

McCullough's Radiation Well Logger, using the highly efficient scintillation counter, will give you the most informative, most accurate Gamma Ray and Neutron Logs available.

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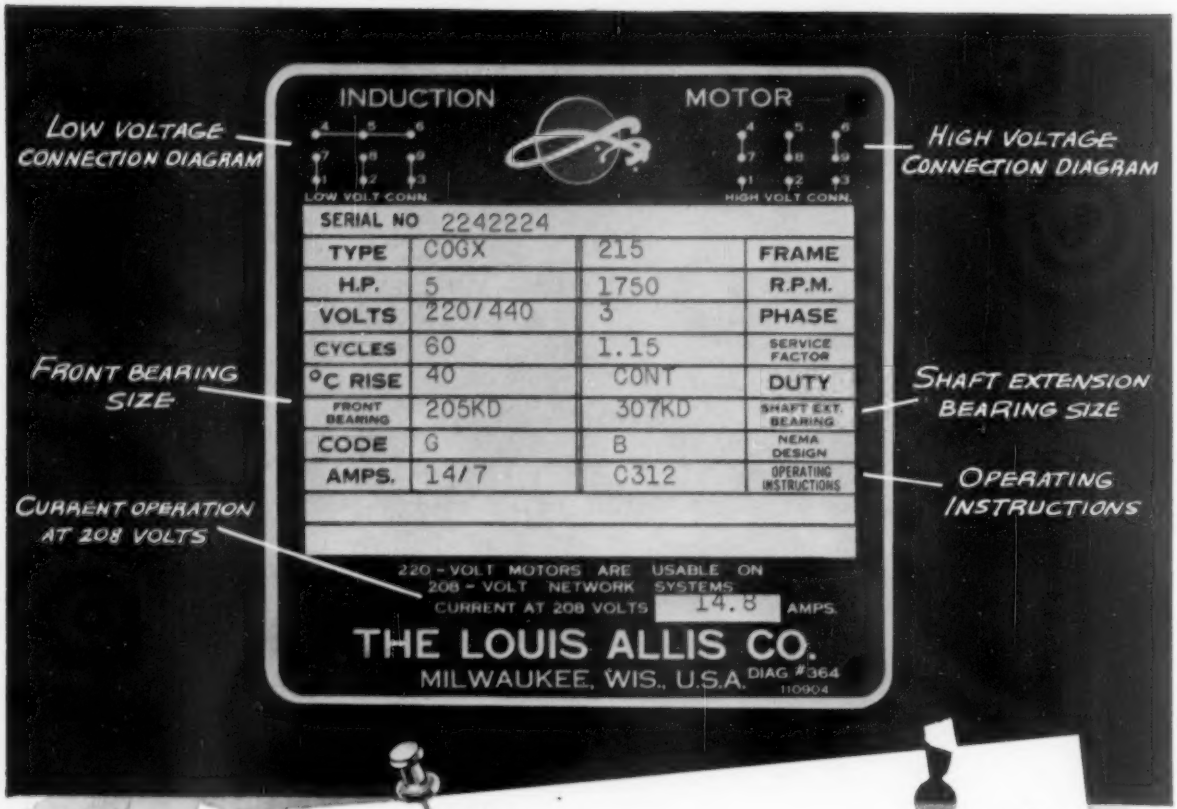
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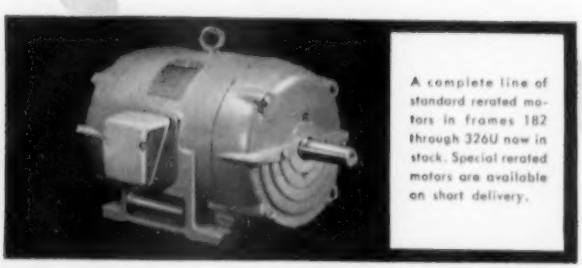

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THE LOUIS ALLIS CO.
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C. W. Smith, geologist with Frontier Oil Co., has opened consultant offices in Wichita.

Ralph M. Boyd, manager of Tidewater Oil Co.'s Drumright, Okla., refinery, has joined Refinery Engineering Co. as an administrative assistant.

George O. Relf, Jr., division chief geologist for Gulf Oil Corp.'s Houston production division, has been named exploration manager of the division. Relf succeeds the late George B. Lamb. A graduate of the University of Utah, Relf joined Gulf's Venezuelan subsidiary, Mene Grande Oil Co. in 1937. In Venezuela he served as Mene Grande's assistant division geologist for Eastern Venezuela and later as assistant chief geologist. He was transferred to Houston in 1955.

Paul R. Beach, oil and gas attorney of Kansas City, has been named head of the Bureau of Land Management's Outer Continental Shelf office in New Orleans. He succeeds **Sidney L. Groom,** who has resigned to open a law office in Houston.

C. C. Irby has been named manager-operations staff for Sohio Petroleum Co. in Oklahoma City. **L. F. Elkins,** chief engineer of the company, has been promoted to technical adviser to the general manager. **E. E. Young,** assistant chief engineer, will replace Elkins.

Dr. R. N. Meinert, associate coordinator of production research for Standard Oil Co. (N. J.) in New York City, has been appointed manager of production research coordination for Carter Oil Co. in Tulsa.

A. L. Reed has been elected president of United Oil & Royalty Co. of Dallas. **Ted E. Edwards** is executive vice president. United Oil & Royalty is a new firm resulting from a merger of United Oil & Royalty Co. of Dallas and Mountain Oil & Gas Co. of Hobbs, N. M.

William T. Smith has been appointed division geologist for the North Texas-New Mexico division of Stanolind Oil & Gas Co. He succeeds **John G. Voight,** who has resigned. Smith was formerly district geologist and supervisor of exploration activities in the company's Abilene, Tex., district. **Lawson F. Jacks, Jr.,** will replace Smith in Abilene.

Charles M. Wanner, formerly with Carter Oil Co. in Carmi, Ill., has opened geological consultant offices in Rawlins, Wyo.

Maurice R. Teis has resigned as partner and vice president of Delta Petroleum Corp., Tulsa, and has opened an office as geologist and independent operator in Tulsa.

J. E. Marsland, manager of Shell Oil Co.'s manufacturing technological department in New York, has been appointed assistant to the executive vice president.

J. E. Springborn, reservoir engineer for Shell Oil Co. in Wichita Falls, Tex., has been promoted to division reservoir engineer. **D. D. Stokes,** exploitation engineer at Ardmore, Okla., will replace Springborn as reservoir engineer in Wichita Falls.

Robert O. Brown, assistant chief engineer for American Oil Co. in New York, has been promoted to manager of engineering and construction for the marketing department. He replaces **George E. Blatchley,** who has retired.

Jack Nottingham, formerly geologist for the old Mid-Continent Petroleum Corp., and later for Lario Oil & Gas Co., has joined Trice Production Co. as district geologist at Midland, Tex.

Dr. Arthur W. Nauss, president and managing director of Scurry-Rainbow Oil, Ltd., of Calgary, has resigned to become president of Klintar Oils, Ltd., Calgary. He will continue as a director and consulting geologist with Scurry-Rainbow Oil. **William H. Farrand** has been named managing director replacing Dr. Nauss.

T. M. Kerr, executive vice president of Kerr-McGee Oil Industries, Inc., has been elected vice chairman of the board of directors. **F. C. Love,** general vice president, will become executive vice president, succeeding Kerr. **A. T. F. Seale,** vice president of manufacturing, has been appointed vice president of operations. Three vice presidents of Deep Rock Oil Co. before its merger with Kerr-McGee in April of 1955, have been named vice presidents of Kerr-McGee. They are **W. M. Murray,** vice president of general sales; **R. M. Chesney,** vice president of refining; and **J. W. Roach,** vice president of crude-oil supply, pipelines, and refinery technical services. **G. B. Parks,** manager of production and drilling operations for Kerr-McGee, has been named vice president of production and drilling operations.

Personals

Edward E. Weadock has been named head of the new Craig, Colo., office of Core Laboratories, Inc.

W. H. Pease, formerly with **Mesa** Drilling Co., has formed Pease **Drilling** Co. with headquarters in Grand Junction, Colo.

William H. Neely, formerly **chief** geologist for Morris G. Spencer, **Dallas** independent, has joined the **geological** staff of Harry Bass Drilling **Co. in** Dallas.

Robert A. Paul, Queensland, **Australia,** manager for Shell Co. of **Australia,** Ltd., has been named a director **of the** company. Paul joined Shell in 1929 **in** London.

Dr. Heinz Heinemann, section chief in charge of process research at Houdry Process Corp.'s Linwood, Pa., **laboratories,** has been elected president of the International Congress on Catalysis. Heinemann and **Dr. Alex G. Oblad,** vice president and director of Houdry, have been reelected directors of the group.

Joseph A. Dunphy, Jr., technologist at Tidewater Oil Co.'s Avon refinery, Associated, Calif., has been promoted to engineer in the dispatching department at Delaware City, Del.

W. SOUDRIETTE

William C. Soudriette, staff assistant in the refining division of Cities Service Oil Co. in Bartlesville, Okla., has been appointed plant manager of the company's East Chicago, Ind., refinery. He succeeds **L. E. Taylor,** who has been named chief engineer of Petroleum Chemicals, Inc., an affiliate of Cities Service. **John A. Witherspoon,** assistant plant superintendent of the East Chicago refinery, has been appointed assistant manager in charge of operations.

G. G. Moore, formerly of Pan-Am Southern Corp., has been appointed division superintendent of Service Pipe Line Co.'s new El Dorado, Ark., district. The district was created after Service Pipe Line's recent purchase of Pan-Am Southern's crude oil pipeline facilities. **John A. Grant** has been appointed district superintendent of Service Pipe Line's new Beaumont district.

Personals

F. C. McLarty, civil engineer with the Goldston Co., has joined Plymouth Oil Co. in Sinton, Tex., as assistant chief civil engineer.

Ken E. Merren of McAlester Fuel Co. has been transferred from Magnolia, Ark., to Midland, Tex., as district geologist for the West Texas-New Mexico area. **James E. Eaton** also has been transferred from Magnolia to Midland as staff geologist.

Gene Reid, Jr., formerly exploration geologist and exploitation engineer for Shell Oil Co. at Ventura, Calif., has joined Gene Reid Drilling, Inc., Bakersfield, Calif., as geologist and petroleum engineer.

Dr. Rolla W. Miller, research director of the Peoples Natural Gas Co., has retired. A director of the Utility Survey Commission in Pittsburgh and senior fellow of the Mellon Institute, Miller has held his present position since 1933.

F. R. Coryn, division geophysicist in The Texas Co.'s Oklahoma division, has been promoted to senior geophysicist in the company's geophysical division. He will move from Tulsa to Houston. **LeRoy McCravey,** formerly in the general manager's office in Houston, will replace Coryn as division geophysicist in Tulsa.

Harvey Cash, general manager of Eastern Hemisphere operations for The Texas Co., has been appointed assistant to the chairman of the board. Cash joined the company in 1933.

W. E. Winn, manager of Southern Natural Gas Co.'s exploration and production division, has been elected vice president in charge of production. He was with Sun Oil Co. and Aetna Oil Co. before joining Southern Natural Gas in 1952.

S. W. Darling, assistant superintendent of The Texas Co.'s Lawrenceville, Ill., refinery, and **V. K. Brandenburg,** assistant superintendent at the company's West Tulsa refinery, have exchanged jobs, Darling moving to Tulsa and Brandenburg to Lawrenceville.

Joe E. Dozier, development engineer for Shell Oil Co. at Long Beach, Calif., has been promoted to district production superintendent at Brea, Calif. **Siegfried H. Haman,** junior development engineer, has been named development engineer at Long Beach.

Walter S. Svenson, assistant manager of The California Oil Co.'s process development department, in Perth Amboy, N. J., has been promoted to manager. He succeeds **E. E. Gullekson,** who has been transferred to San Francisco.

Ralph E. Damp, engineering executive of Standard Oil Co. (N. J.), has been elected president and a director of Swan-Finch Oil Corp., affiliate of Jersey Standard. Damp has been with Jersey Standard and its affiliates since 1926 when he joined Carter Oil Co. as a chemical engineer.

Harold E. Krueger, formerly of the crude oil coordination department of Standard Oil Co. (Ind.), in Chicago, has joined Stanolind Oil Purchasing Co.'s coordinating department in Tulsa.

Louis R. Roberts, chemist with Gulf Oil Corp. in Port Arthur, Tex., has joined Southwest Research Institute in San Antonio, Tex., as associate chemical engineer.

Louis F. Goss has been promoted to district geologist for Seaboard Oil Co. in Abilene, Tex. He replaces **Tom Baker,** who has been transferred to Ardmore, Okla.

Norman E. Gustavson of Gustavson Drilling Co., Calgary, has been named president of the Canadian Association of Oilwell Drilling Contractors. He succeeds **C. E. Thornton** of Reading & Bates Drilling Co., Inc., Denver.

R. H. Coe has been named divisional engineer in Sun Oil Co.'s Tulsa central division.

T. B. Pengilly has been named production foreman of Shell Oil Co.'s Calgary division. He has been with Shell 6 years.

R. D. Turner, formerly in charge of natural-gas sales for Skelly Oil Co., has opened gas consultant offices in Tulsa.

F. W. Rood, senior engineer in Shell Oil Co.'s manufacturing engineering department in New York, has been named assistant chief engineer at the company's Wood River refinery.

Ralph R. McCoy, president of Pate Oil Co., midwestern marketing affiliate of Standard Oil Co. (N. J.), has been named president of South Side Petroleum Co. and Perfect Power Corp., two Chicago marketing organizations recently acquired by Jersey Standard.

Gerald P. Salisbury, district geologist in the Abilene, Tex., office of Union Oil Co. of California, has been appointed district geologist for the north half of the West Texas Permian basin with headquarters in Midland, Tex. **Ashton T. Perry, Jr.,** succeeds Salisbury as district geologist at Abilene.

H. L. Coots has been transferred by General Petroleum Corp. from resident manager at Willows, Calif., to resident manager at Taft, Calif. **S. M. Young** has been promoted to drilling foreman at the company's Taft office. **W. H. Minner** has been named production foreman at General Petroleum's Lost Hills-Belridge location.

DEATHS

Al W. Hamill, 80, driller of the Lucas gusher at Spindletop Hill near Beaumont, Tex., died of cancer September 29 in Tulsa. Among the first to use the rotary-drilling method, Hamill and his brother, Jim, were hired to bring in the historic Lucas gusher after four previous attempts had been stymied by quicksand. Hamill and his brothers were later active in oil developments in the Southwest and in California.

J. A. McDaniel, 52, independent oil and mining operator in Mont Belvieu, Tex., died September 26 in Dayton, Tex., after a heart attack.

Eugene J. Sullivan, 82, of Casper, Wyo., once director of the former Mackinnie Oil & Drilling Co. and Arco Oil Co., died recently while vacationing in Boston. Sullivan helped found the Rocky Mountain Oil and Gas Association.

John L. (Jack) Steele, 60, operator of the Steele Oil Co. and Steele Drilling Co., died September 27 in Denver after a heart attack. Steele was credited with discovering new producing sands in the Glenrock oil field south of Casper, Wyo.

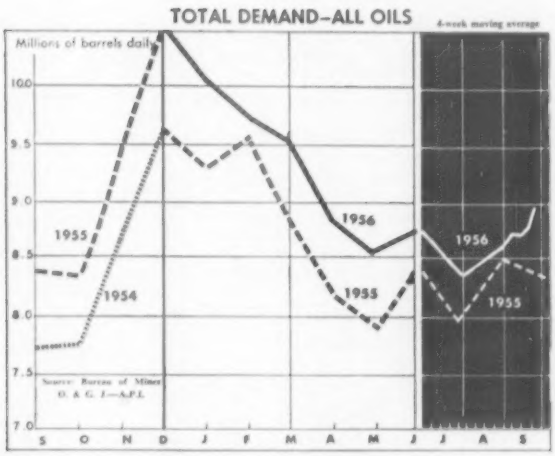
Henry Gerson Steinau, 80, pioneer North Louisiana independent oil operator who helped develop the old Homer field, died September 27 in Shreveport, La.

Frank W. Sutton, 81, oil field and pipeline equipment inventor and manufacturer, died September 28 in Tulsa.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,059,650	DOWN	17,200	UP	318,345
Crude stocks	274,603,000	UP	174,000	UP	19,969,000
Completions	1,035	DOWN	40	DOWN	293
Refinery runs	7,897,000	DOWN	144,000	UP	435,000
Gasoline stocks	174,720,000	DOWN	2,224,000	UP	23,454,000
Kerosine stocks	33,817,000	UP	160,000	DOWN	2,596,000
Distillate stocks	150,367,000	UP	1,551,000	UP	6,645,000
Residual stocks	47,499,000	DOWN	336,000	UP	745,000
Four-product stocks	406,403,000	DOWN	849,000	UP	28,248,000
Total imports	1,567,000	UP	202,200	UP	286,900



Seasonal Upturn of Heating-Oil Prices Continues on East Coast

LIGHT heating oils are slightly stronger in most market areas, but the gains in both sales and prices represent only normal seasonal trends.

Esso Standard Oil Co. announced varying increases in prices charged for light heating oils throughout its marketing area, effective October 1. Tank-car prices for the fuels were raised 0.2 cent a gallon at Charleston, S. C., and at Wilmington and Morehead City, N. C. The largest increase was at Albany, N. Y., where the price moved up 0.5 cent a gallon.

Barge prices for the New York Harbor area were raised 0.4 cent a gallon. The new price for barge delivery of kerosine is 11.25 cents a gallon. No. 2 fuel now brings 10.75 cents.

While this is the first increase for the area since early in January, it represents a net gain since there were no discounts during the summer months on purchases for summer fill.

Here is a rundown of price changes in 1955 compared with 1956. Quotations are for barge delivery of No. 2 fuel. At the start of the year 1955, No. 2 fuel was selling for 9.95 cents a gallon. The first cut came in the first week of April when the low quotation was down to 9.80 cents. This was followed by a reduction to 9.65 cents during the third week of April and by another to 9.3 cents in the first week of May. This was the summer-fill price for the early part of the summer.

Prices started back up about the middle of August with a quotation of 9.55 cents. Another increase in the last week of November, amounting to 0.5 cent a gallon, gave a price of 10.25 cents. The 0.3-cent increase on January 6 of this year produced the price of 10.35 cents that held until the latest raise on October 1.

The price increase on the East Coast is a direct result of the 0.25-cent raise on the Gulf Coast a week earlier. The outlook for higher tanker rates also is a factor.

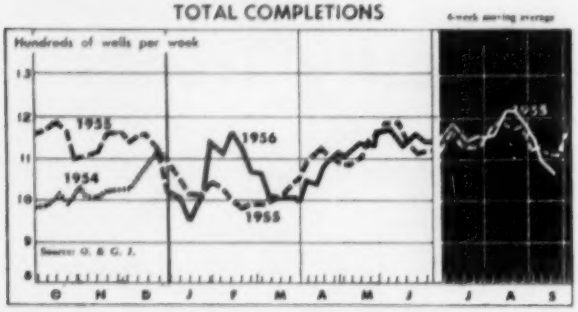
Tanker rates normally decrease in the spring and summer months and increase with the gains in demand during the winter season. Gulf-East Coast rates ranged from USMC plus 15 per cent to USMC plus 50 per cent during the first 6 weeks of this year. Early in March the rate dropped to USMC minus 20 per cent. Since that time, the rate has changed from USMC plus 100 per cent early in May to USMC plus 42.5 per cent in the first week of August.

If the Suez Canal trouble produces the expected tanker shortage between now and the first of the year, tanker rates on the Gulf-East Coast run will move well above USMC plus 100 per cent.

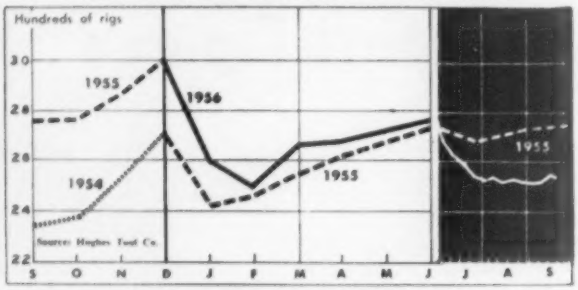
The flat USMC rate represents about 0.9 cent a gallon for moving No. 2 fuel from the Gulf Coast to points north of Hatteras. When the rate moves to USMC plus 100 per cent, an additional 0.9 cent has been added to the cost of light heating oil in New York Harbor. Before the winter is over, it may be necessary to raise East Coast prices by at least another 0.5 cent a gallon to get the needed home-heating fuel for the winter season.

Some improvement has been reported for movement of distillate fuels in the Mid-Continent and North Central areas, but not enough to produce a price change.

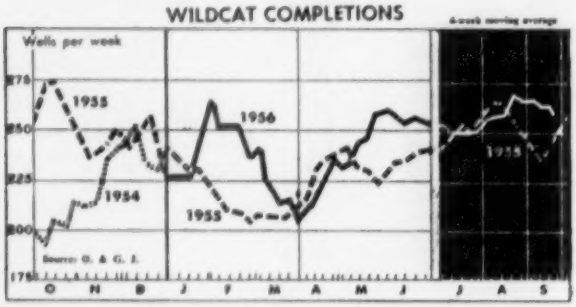
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	10-1-56	9-24-56	10-3-55
North Central and East	142	132	132
Southeast	37	38	36
Okla., Kans., Ark., Mo.	449	454	524
Louisiana	420	439	425
North and East Texas-Panhandle	372	375	391
Gulf and South Texas	244	243	254
West Texas-New Mexico	500	495	541
Rocky Mountain	276	269	313
Pacific Coast	106	114	139
Total United States	2,546	2,559	2,755
Western Canada	242	241	180

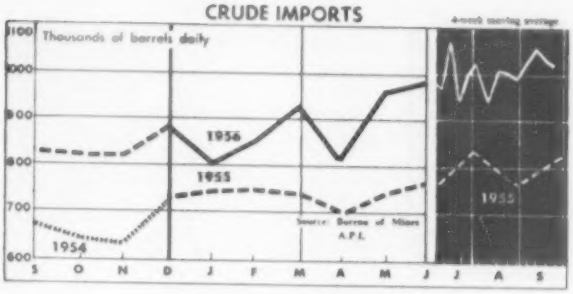
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 29, 1956

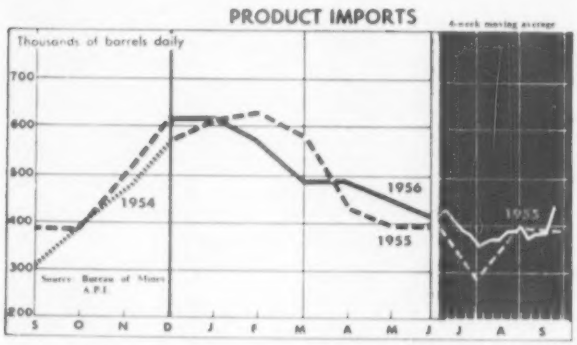
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	1	0	1	18,383	81	61	0	0	0	1	1	0	0	1	35	36
Arkansas	33	26	1	6	88,649	676	599	1	0	1	2	4	28	0	4	110	142
California	33	18	1	14	153,039	1,656	1,827	2	0	1	14	17	41	0	9	347	397
Colorado	27	6	1	20	130,328	886	1,117	1	0	0	17	18	20	0	11	441	473
Illinois	79	41	0	38	192,761	2,871	2,885	0	0	0	10	10	38	0	3	516	557
Indiana	11	5	0	6	15,458	504	555	0	0	0	0	0	14	0	1	88	103
Kansas	108	44	21	*43	389,710	3,757	3,781	3	0	0	20	23	92	2	30	681	805
Kentucky	47	20	5	22	68,378	1,383	1,140	1	0	0	7	8	31	0	1	287	319
Louisiana	66	37	10	19	349,681	2,854	2,982	0	0	1	4	5	86	44	45	393	568
North	45	27	8	10	144,804	1,240	1,551	0	0	0	2	2	23	2	3	161	189
South	17	8	2	7	178,412	1,297	1,431	0	0	1	2	3	51	37	30	203	321
Offshore	4	2	0	2	26,465	317		0	0	0	0	0	12	5	12	29	58
Michigan	10	3	2	5	33,503	330	398	0	0	0	5	5	7	0	1	122	130
Mississippi	5	1	0	4	27,832	335	338	0	0	0	4	4	13	1	1	149	164
Montana	13	8	0	5	53,233	341	266	0	0	0	4	4	10	0	1	113	124
Nebraska	18	5	0	13	105,201	739	634	1	0	0	9	10	31	0	0	329	360
New Mexico	24	11	5	8	106,679	1,453	1,271	0	0	0	6	6	37	0	8	152	197
Northwest	13	5	5	3	53,143	626	422	0	0	0	2	2	8	0	7	51	66
Southeast	11	6	0	5	53,536	827	849	0	0	0	4	4	29	0	1	101	131
North Dakota	10	8	0	2	86,887	191	190	0	0	0	1	1	8	0	0	50	58
Ohio	0	0	0	0	0	768	902	0	0	0	0	0	2	0	2	5	9
Oklahoma	116	73	2	†41	381,592	6,307	6,434	1	0	1	8	10	97	16	30	527	670
Pennsylvania-New York	2	0	2	0	6,016	766	1,162	0	0	0	0	0	0	0	9	11	20
Texas	399	222	12	165	1,759,861	16,666	15,195	14	0	2	102	118	572	28	140	3,504	4,244
Southwest (1 & 4)	60	29	5	26	213,893	2,388	2,330	4	0	1	19	24	107	6	47	656	816
Gulf Coast (2 & 3)	52	26	0	26	393,726	1,994	1,885	2	0	0	17	19	52	14	50	534	650
East (5 & 6)	25	15	0	10	123,654	866	731	0	0	0	6	6	12	2	5	289	308
N. Central (7-B & 9)	146	67	2	77	435,924	5,980	5,753	4	0	1	38	43	254	0	10	1,418	1,682
West (7-C & 8)	96	73	0	23	506,935	4,447	3,706	3	0	0	20	23	132	0	9	558	699
Panhandle (10)	20	12	5	3	85,729	991	790	1	0	0	2	3	15	6	19	49	89
Utah	1	1	0	0	5,891	96	73	0	0	0	0	0	3	0	4	49	56
West Virginia	15	1	12	2	50,987	506	480	0	0	1	1	2	0	0	9	9	18
Wyoming	16	9	2	5	55,010	632	637	2	0	0	4	6	14	0	8	161	183
Miscellaneous	0	0	0	0	0	70	43	0	0	0	0	0	4	0	0	58	62
Total U. S.	1,035	540	76	419	4,079,079	43,868	42,970	26	0	7	219	252	1,148	91	318	8,138	9,695
Total previous week	1,075	514	84	477	4,601,441			34	3	11	228	276	1,122	91	311	7,919	9,443
Total Oct. 1, 1955	1,328	733	95	500	5,306,276			38	10	4	212	264	1,236	160	269	7,497	9,162
Cumulative 1956	43,868	23,726	3,004	17,138	176,817,227												
Western Canada	83	60	5	18	384,708	2,335											

Service wells included: *1, †4.

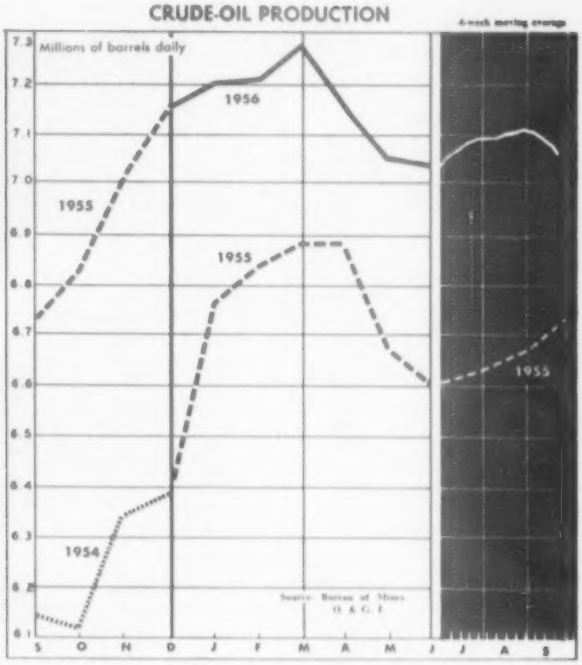
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

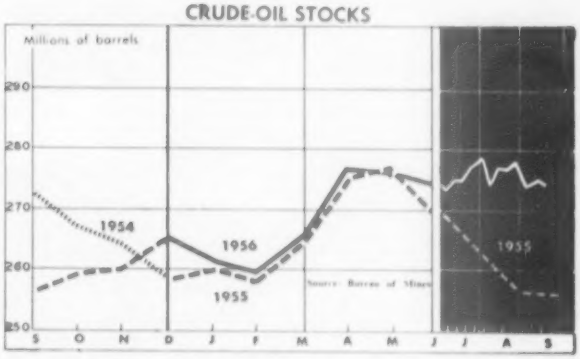


DAILY AVERAGE PRODUCTION FOR WEEK

	September 29, 1956			Sept. 22
	Crude oil	Lease condensate	Total	total
Alabama	9,000		9,000	9,150
Arkansas	79,350	300	79,650	79,950
California	958,200		958,200	958,600
Colorado	160,200		160,200	159,800
Eastern	51,300		51,300	50,900
Florida	1,325		1,325	1,325
Illinois	237,300		237,300	235,200
Indiana	32,300		32,300	31,000
Kansas	338,900		338,900	342,200
Kentucky	47,100		47,100	46,900
Louisiana	732,050	57,100	789,150	788,900
North	119,550	2,100	121,650	121,400
South	612,500	55,000	667,500	667,500
Michigan	29,000		29,000	28,000
Mississippi	108,000	4,625	112,625	113,425
Montana	63,600		63,600	63,100
Nebraska	39,100		39,100	37,200
Nevada	200		200	200
New Mexico	238,000	3,800	241,800	241,800
North Dakota	35,200		35,200	35,300
Oklahoma	†573,300		†573,300	†591,600
Texas	2,914,000	51,300	2,965,300	2,965,300
Dist. 1	56,000	450	56,450	56,450
Dist. 2	143,000	8,100	151,100	151,100
Dist. 3	419,000	24,200	443,200	443,200
Dist. 4	235,000	6,200	241,200	241,200
Dist. 5	42,500	400	42,900	42,900
Dist. 6	124,000	5,875	129,875	129,875
East Texas Field	202,000		202,000	202,000
Dist. 7-B	159,000	50	159,050	159,050
Dist. 7-C	180,000	3,750	183,750	183,750
Dist. 8	1,040,000	1,600	1,041,600	1,041,600
Dist. 9	213,000	475	213,475	213,475
Dist. 10	100,500	200	100,700	100,700
Utah	5,100		5,100	7,200
Wyoming	289,900		289,900	289,700
Others	‡100		‡100	100
Total U. S.	6,942,525	117,125	**7,059,650**	7,076,850
Change from previous week, down			**17,200**	
Canada	†501,000		†501,000	†497,900
Total U. S. production—Jan. 1-Sept. 29			1,949,471,250 bbl.	
Same period last year (crude plus condensate)			*1,834,156,321 bbl.	

*Includes 30,529,300 bbl. condensate. †Week ended previous Monday. ‡S. Dakota.

CRUDE-OIL STOCKS



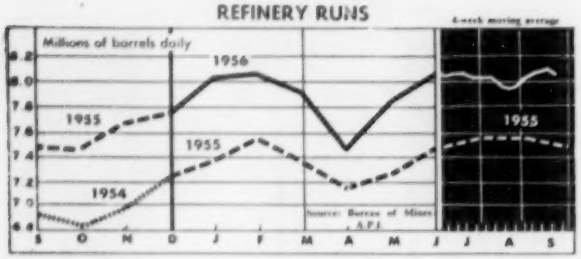
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

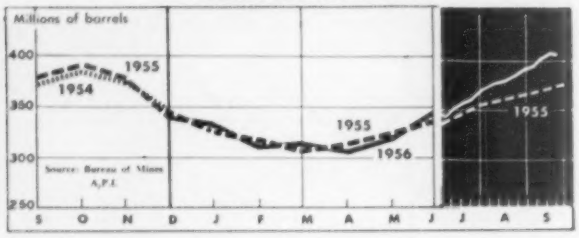
	9-22-56	9-15-56	9-24-55
Pennsylvania Grade	2,539	2,551	3,262
Other Appalachian	2,362	2,410	1,904
Illinois, Indiana, Michigan	11,460	11,359	9,995
Nebraska, North Dakota	2,220	2,364	2,199
Kansas	10,059	10,010	8,003
Oklahoma	25,871	25,949	20,766
Arkansas	2,719	2,924	2,530
Louisiana	17,839	17,164	16,256
North	2,500	2,497	2,726
South	15,339	14,667	13,530
Mississippi	2,990	3,055	3,149
New Mexico	8,412	8,278	7,461
Texas	121,912	121,805	119,628
East Texas proper	8,729	8,822	8,871
West Texas	58,642	59,097	57,074
Texas Gulf	23,250	23,488	24,546
Other Texas	31,291	30,398	29,137
Wyoming	17,155	17,098	14,654
Other Rocky Mountain	6,137	6,476	5,015
California	27,320	27,384	28,019
Foreign	15,608	15,602	11,793
Total	274,603	274,429	254,634

*Bureau of Mines. †Includes 4,491,000 bbl. in California.

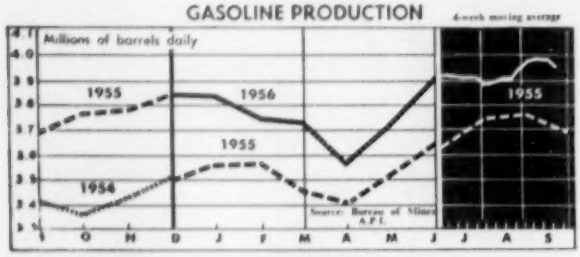
REFINERY RUNS



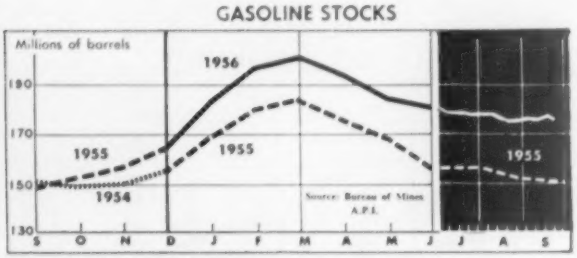
FOUR-PRODUCT STOCKS



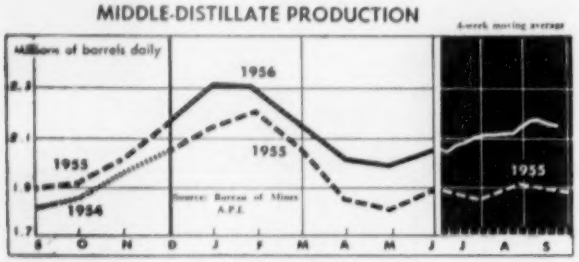
GASOLINE PRODUCTION



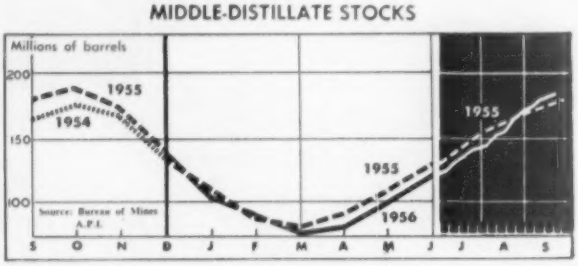
GASOLINE STOCKS



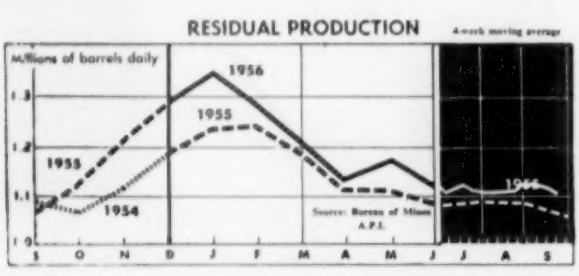
MIDDLE-DISTILLATE PRODUCTION



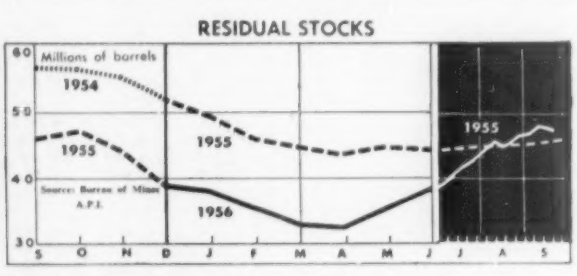
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, SEPTEMBER 28, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, September 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,129	476.4	45.9	318.6	185.7	43,104	12,942	55,217	12,206	1,085	463.7	31.5	257.9	191.0
Appalachian:														
District 1	104	49.3	5.3	24.3	4.3	4,565	589	3,405	511	94	40.1	3.8	21.6	7.3
District 2	81	42.4	4.9	14.1	11.0	2,989	755	929	458	97	54.7	1.6	14.3	11.0
Ind., Ill., Ky.	1,438	743.4	76.1	300.0	151.9	31,371	7,348	22,848	5,432	1,296	686.7	50.7	250.7	141.7
Minn., Wis., Dak.	94	47.7	8.1	21.7	6.7	6,463	1,784	8,149	169	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	664	370.3	9.7	159.0	31.4	14,725	1,999	13,629	1,438	703	421.5	21.6	167.2	29.4
Inland Texas	265	209.7	9.4	48.7	22.6	7,414	573	2,191	1,741	264	195.9	7.0	53.0	22.0
Texas Gulf Coast	1,897	929.9	134.4	460.2	252.6	23,326	3,981	17,639	6,987	1,781	845.0	94.6	444.3	218.2
La. Gulf Coast	698	337.7	44.9	207.2	56.1	9,731	2,342	7,308	1,788	662	337.3	53.7	161.8	44.3
N. La. and Ark.	101	38.7	9.9	23.3	5.3	4,575	650	1,974	247	88	33.9	7.4	21.9	5.6
Rocky Mountain:														
New Mexico	21	11.3	0.3	4.1	2.6	423	9	102	46	19	10.2	0.2	3.1	2.7
Other Rocky Mtn.	256	119.3	6.0	50.7	33.7	5,023	495	3,321	870	258	119.9	2.5	56.8	36.2
West Coast	1,149	494.3		188.7	325.0	21,011	350	13,655	15,606	1,136	486.9	4.2	167.7	351.1
Sept. 28, 1956	7,897	3,870.4	354.9	1,820.6	1,088.9	174,720	33,817	150,367	47,499	7,483	3,695.8	278.8	1,620.5	1,060.5
Sept. 21, 1956	8,041	3,905.9	338.4	1,754.0	1,096.9	176,944	33,657	148,816	47,835					
Sept. 30, 1955	7,462	3,635.4	287.4	1,549.0	1,061.4	151,266	36,413	143,722	46,754					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Indiana, Illinois, Kentucky district.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.25-11.75
Premium (96 octane)	13.00-13.50
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California—Los Angeles (rack):	
Regular (84 octane)	12.1-12.6
Premium (93 octane)	13.35
Premium (96 octane)	14.3-14.6
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	5.0
Breckenridge:	
Grade 26-70	4.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.75-10.00
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.5
Distillate No. 2	8.75
New York Harbor (barges):	
★ Kerosine 41-43	11.25
★ Distillate No. 2	10.75
★ Diesel fuel, 48-52 d.i.	11.05
Caribbean area (cargoes):	
Distillate No. 2	8.75

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.80
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15-2.25

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25° p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M. (sour)	Wyo.
14-14.9	$2.02				
15-15.9	2.08				
16-16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$3.01	2.45	
25-25.9	2.64	2.60	3.03	2.47	$2.13
26-26.9	2.69	2.62	3.05	2.49	2.19
27-27.9	2.76	2.64	3.07	2.51	2.24
28-28.9	2.83	2.66	3.09	2.53	2.29
29-29.9	2.91	2.68	3.11	2.55	2.34
30-30.9	2.97	2.70	3.13	2.57	2.39
31-31.9	3.04	2.72		2.59	2.44
32-32.9	3.12	2.74		2.61	2.48
33-33.9	3.20	2.76		2.63	2.52
34-34.9	3.27	2.78		2.65	2.56
35-35.9	3.34	2.80		2.67	2.60
36-36.9	3.39	2.82		2.69	2.64
37-37.9		2.84		2.71	2.66
38-38.9		2.86		2.73	2.68
39-39.9		2.88		2.75	2.70
40 and up		2.90		2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	**2.90**
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	$2.80
Tia Juana medium, 26.5°-26.9°, Amuay§	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ N.W.I.-U.S.N.H., dirty (Scale+80%) (30s. 5d.)	$4.24
N.W.I.-U.K., dirty (Scale+105%) (66s. 8d.)	9.28
★ P.G.-U.K., dirty (Scale+135%) (127s. 1d.)	17.70
★ P.G.-U.S.N.H., dirty (USMC+25%)	15.88
★ P.G.-Japan, dirty (USMC+55%)	13.95
★ Lebanon-France, dirty (USMC +57.5%)	8.58

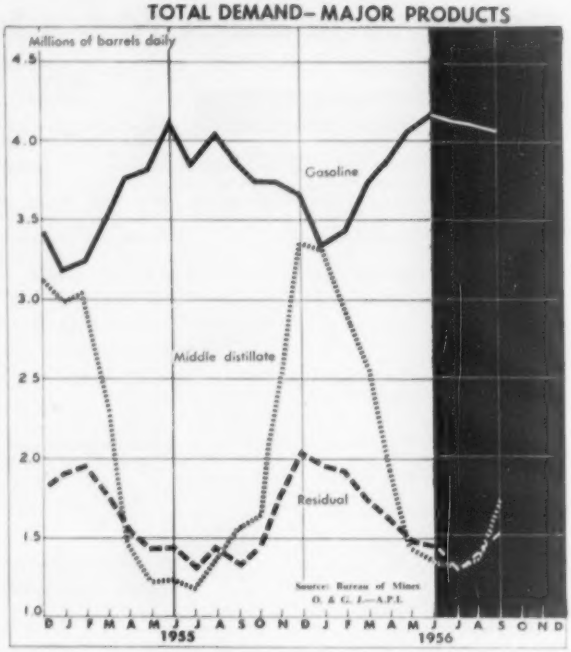
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

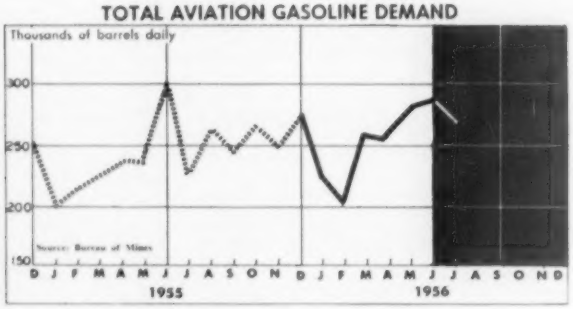
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
September 1956*	4,088	3,935	174,080
August 1956*	4,108	3,947	175,570
July 1956	4,010	3,878	176,536
October 1955	3,740	3,766	153,103
September 1955	3,877	3,696	150,194
KEROSINE			
September 1956*	287	336	33,870
August 1956*	208	312	32,400
July 1956	207	296	28,990
October 1955	297	309	36,705
September 1955	244	279	36,361
DISTILLATE			
September 1956*	1,426	1,814	150,810
August 1956*	1,155	1,831	138,450
July 1956	1,076	1,767	115,787
October 1955	1,334	1,612	152,288
September 1955	1,322	1,621	143,248
RESIDUAL			
September 1956*	1,508	1,102	47,400
August 1956*	1,400	1,122	46,780
July 1956	1,606	1,066	43,958
October 1955	1,453	1,123	47,040
September 1955	1,350	1,061	46,267

*Preliminary. †Thousands of barrels.

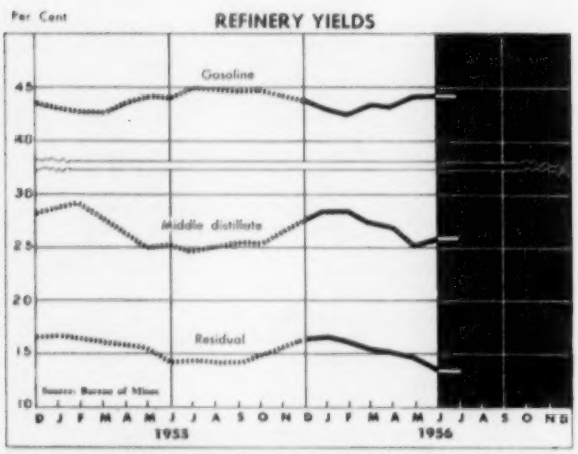
TOTAL DEMAND—MAJOR PRODUCTS



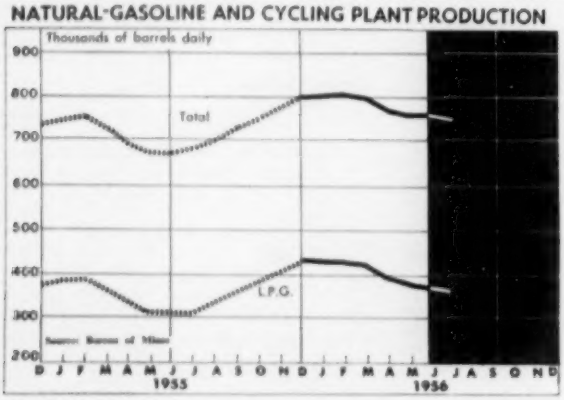
TOTAL AVIATION GASOLINE DEMAND



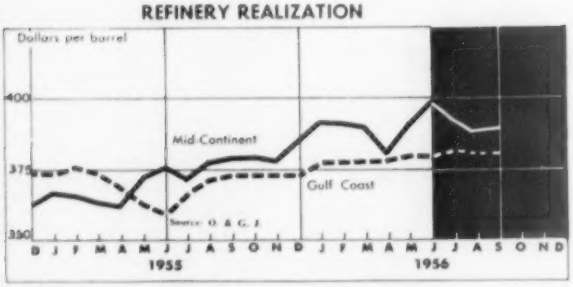
REFINERY YIELDS



NATURAL-GASOLINE AND CYCLING PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Sept.* 1956	Aug.* 1956	July 1956	Sept. 1955
Mid-Continent	$3.88	$3.87	$3.92	$3.79
Gulf Coast	3.81	3.81	3.81	3.73

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

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Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

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3 Pacific ITB, 400 gpm—2,000' hd, 735 gpm—3,100' hd.
5 Pacific SVTB, 612 gpm—600' hd, 324 gpm—480' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—408' HD.

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10—Kellogg Adm. Fltg. Hd. 2700, 2200, 1800 Sq. Ft.
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2 Worth LTC-6 800 hp.
1 Worth LTC-3 400 hp.
3 Penn Comps 100 CFM 500 lbs. 385 CFM 160 lbs.

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6—Adm. 785, 742, 425 sq. ft. ht. exch.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr.
800 ft. of 2" 4-6 ch pipe.
Large quantity of 410 SS chrome strips and sheets.
Tremendous selection stainless steel and steel valves ½"-6".
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Goulds 16" pump, 10500 gpm, 135' hd.

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EQUIPMENT WANTED

WILL BUY FOR CASH—One complete Slim Hole Portable Drilling Rig, Diesel Power, capable of drilling slim hole to 8,000 ft. Prefer location Northern United States with equipment winterized. Box J-746, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Late model 2500 Failing or its equivalent in size, also 28L Bucyrus-Erie Spudder or its equivalent. Please quote price and condition. Box 45, Chanute, Kansas.

WANT TO BUY—2500 to 3000-ft. rotary rig, drill pipe, pump, etc. Cash; no trade. Keith Morton, Conrad, Montana.

HELP WANTED

DITCHER SALES Promotion Manager Wanted: Experienced man to head sales promotional activity of leading manufacturer of expanding ditcher line. Must have sales experience and be familiar with design and application of both wheel and boom type machines. Position involves overall sales management responsibilities with distributors and key customer contacts. Age preferably under 45. Management level compensation. Provide complete experience resume with application. Reply to: Personnel Director, Barber-Greene Company, Aurora, Illinois.

HELP WANTED

ENGINEERS

Chemical, Mechanical, Petroleum, Gas Engineering Graduates. Our company will interview applicants for openings in our natural gas-gasoline department in Mid-Continent, Louisiana, Gulf Coast areas. Two years minimum design and/or operation experience. Salary to suit qualifications. Our employees are aware of this ad. Box J-721, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEER and GEOLOGIST

For Independent in Canadian Operations. Both to be located in Calgary, Alta., Canada. Reply:

BOX J-733,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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Are you worth up to

$10,000 A YEAR?

Important permanent positions, paying from $6,500 to $10,000 a year with unusual future opportunity, have been created by the expansion program of our large, long-established engineering and construction firm. We need qualified engineers, designers and draftsmen experienced in structural, concrete, mechanical and piping design. Engineering offices are in several major American cities and Canada. Excellent working conditions. Generous company benefits. Our employees know of this ad.

Investigate this opportunity. Write today, giving age, education and experience. Your inquiry will be kept strictly confidential and will be answered promptly.

Box J-739,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

RESERVOIR ENGINEER and GEOLOGIST

For Independent In Mid-Continent Area. Both to be located in Oklahoma City. Reply:

BOX J-734,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

MAINTENANCE ENGINEERS

Plant Equipment Inspectors

Openings for graduate Metallurgical, Chemical, Mechanical and Industrial Engineers in new Chemical Maintenance Engineering Section of Pittsburgh Coke & Chemical Company.

Graduate engineers in the above mentioned classifications having 0 to 10 years experience in chemical plants or petroleum refineries write or call:

Carl D. Thomas, Supervisor
Maintenance Engineering

PITTSBURGH COKE & CHEMICAL COMPANY
Neville Island
Pittsburgh 25, Pennsylvania
SPalding 1-4400

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Several qualified graduate engineers — Chemical, Mechanical or Petroleum — can broaden their professional responsibilities in our Chemical Engineering Department.

Assignments will cover the application of processes to a wide variety of industrial plants, ranging from complete integrated refineries and chemical processing centers through all types of individual process units. The work includes coordination of chemical engineering, the selection and design of process equipment and machinery, and startup of completed plants.

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SENIOR ELECTRICAL
SENIOR MECHANICAL

San Francisco opportunity for senior electrical or mechanical engineers with experience on oil pipeline and pumping stations or gas pipeline and compressor stations.

Send resume to Manager of Employment & Placement
Industrial Relations Division

BECHTEL CORPORATION
220 Bush Street
San Francisco 4, Calif.

For an immediate personal interview you may phone:

Paul Keating, PLaza 7-4400, New York City
Joe Braddick, FAirfax 3-2401, Houston, Texas
Bill Milligan, TUcker 1549, Los Angeles, Calif.
Don Palmer, DOuglas 2-4032, San Francisco, Calif.

HELP WANTED

HYDRAULIC CASING pulling unit operators and helpers. Call GLadstone 3-6681, Great Bend, Kansas.

PETROLEUM ENGINEER with about two years experience wanted by major oil company for training in oil reserve and valuation work. Permanent Tulsa location with opportunity for advancement. Replies should furnish complete personal data, education, experience and salary requirements. Box J-769, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS WANTED—Oil well drilling tool manufacturer has opening for Design or Field Engineers familiar with rock bits. Should have technical education with some experience preferred. Excellent opportunity in an expanding Engineering Department. Write giving details of education and previous experience to Chicago Pneumatic Tool Company, Box 1990, Fort Worth, Texas.

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MECHANICAL ENGINEER

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Technical work in small expanding department of a MAJOR OIL CO. New York City location with some travel entailed.

Excellent opportunity for man with initiative. Salary commensurate with experience. Fine employee benefit program.

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Box J-745,
The Oil and Gas Journal,
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- **TOOL PUSHERS**—3 to 5 years experience. Age to 40.
- **GEOLOGIST**—Degree. Single. Age to 32.
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All information confidential.
Send Resume to:

CHAS. J. LOVELESS
PERSONNEL SERVICE
616 S. Main • TULSA, OKLA. • GI 7-3193

HELP WANTED

GEOLOGIST & PETROLEUM ENGINEER—Oil Company with substantial holdings in South Arkansas and Northern Louisiana is expanding their organization. Excellent opportunity for a young geologist and an engineer with a minimum of two years experience in the area. Applicants for both positions must be willing to relocate in Dallas. Submit complete resume of education, experience, references, and salary expected. All replies confidential. Reply Box J-748, The Oil and Gas Journal, Tulsa, Oklahoma.

OPERATIONS ENGINEER

Growing independent oil company wants petroleum engineer with three to six years of practical, technical, and administrative experience for position in operations planning and control section. Some knowledge of valuation work and oil and gas law would also be helpful. Reply should furnish details on education, experience, and references, and state age and required starting salary.

BOX J-784,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

PRODUCTION ENGINEER—For responsible position with large Independent Company operating primarily in Kansas and Oklahoma. Five to ten years experience to qualify. State qualifications and give salary requirements. Box J-747, The Oil and Gas Journal, Tulsa, Oklahoma.

RIG MECHANICS
DRILLERS

FOR FOREIGN EMPLOYMENT

Large company operating in Egypt has openings for experienced rig mechanics and drillers. Write giving age, marital status, education, experience and telephone number.

Attention of SHROGJ

Sahara Petroleum Co.

625 MADISON AVENUE
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Experienced Refinery Personnel For Baghdad, Iraq

For work in a modern, complete refinery operation

Three year extendable contract with provisions for:

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• NO INCOME TAX

Applications solicited on confidential basis for following posts:

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Yard and Cleanout (Rigger) Foreman
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Shop Foreman
Pump and Engine Foreman
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Chief Chemist and Coordinator
LPGas Engineer, Production and Distribution
Assistant Chief Accountant for Lube Oil Operations
Lube Process Engineers
Engine Test Engineer and Assistant
Shift Foremen, Lube Operations
Shift Operators for Vacuum Distillation
Shift Operators for Propane Deasphalting, Asphalt Blowing
Shift Operators for Furfural Treating
Shift Operators for Propane Dewaxing
Shift Operators for Clay Percolation and Acid Treatment
Foreman, Compounding Blending, Filling
Foreman, Can and Drum Making
Foreman, Asphalt Blending and Filling
Boardmen (Controlmen) for Vacuum Distillation
Boardmen (Controlmen) for Propane Deasphalting, Asphalt Blowing
Boardmen (Controlmen) for Furfural Treating
Assistant Operators, Propane Dewaxing
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In most job categories, services are estimated to begin in Baghdad After Christmas, 1956

Please send complete resume of background experience to:

OVERSEAS EMPLOYMENT SECTION

CHAS. J. LOVELESS PERSONNEL SERVICE

616 South Main Street, Tulsa, Oklahoma
Cable: LOPESE Telephone Gibson 7-3193

HELP WANTED

SALES REPRESENTATIVE. Oil field drills and equipment. Must have broad knowledge of petroleum exploration and oil field drilling equipment. Oklahoma, Kansas, Arkansas and Texas Panhandle territory. Salary plus bonus and expenses. Write Box J-742, The Oil and Gas Journal, Tulsa, Oklahoma.

SPECIAL PETROLEUM REPRESENTATIVE

Established manufacturer of industrial processing materials has opening for a special representative in the Great Lakes Region.

Applicants must be 25-40 years of age, and must have petroleum refinery experience in the mechanical, engineering, processing, or operations department. 60% travel, salary, plus expenses.

This is an unusual opportunity for a capable man looking for permanency and above average earnings.

Reply giving full details of education, background, and personal status to

Box J-754,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

OIL INDUSTRY Employment Service, 405 Tuloma Bldg., Tulsa, Okla., GI 7-5974, Tom Robinson, owner. For graduate, experienced engineers under 35.

FOREIGN DOMESTIC EMPLOYMENT. List oil companies, drilling contractors, showing where apply foreign jobs $5.00 cash. List 100 large domestic oil companies $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

WANTED: Man with college education plus five to ten years experience with seismic records. Permanent location Houston with long established seismic contracting company. Salary open. Our employees advised of this ad. Write full particulars to Box J-724, The Oil and Gas Journal, Tulsa, Oklahoma.

Opportunity for Division Sales Engineer

For promotional and development sales in the Gulf Coast area with a leading manufacturer of oil well drilling and producing equipment. Products involved are derricks, substructures and related equipment for off shore operation. Splendid opportunity for advancement. Salary commensurate with experience. Replies should include resume of education and experience, as well as salary requirements. Replies will be held in confidence.

BOX J-738,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

NATURAL GAS ENGINEER with engineering degree plus experience in plant design or operation. Location Tulsa. Amerada Petroleum Corporation, Gas Department, P. O. Box 2040, Tulsa, Oklahoma.

PIPELINE ECONOMIC STUDIES

MAJOR CONSULTING ENGINEERING COMPANY
requires
Management Type Man for Developing Economic and Feasibility Reports on Pipeline Systems.

Address:

Box J-743,
The Oil and Gas Journal,
Tulsa, Oklahoma.

WANTED

Pilot with geological training and background to fly well equipped Beechcraft Bonanza, based in Houston, Texas. This is an excellent opportunity for a capable man with these combined talents. Starting salary commensurate with qualifications. Please give full details in letter of application.

Address:

BEECHCRAFT DISTRIBUTOR,
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There are outstanding career opportunities with one of the 100 largest corporations in the United States for men with the following qualifications:

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- **B.S. or higher degree and experience:**
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  - **(Mechanical) in process equipment construction, design, inspection, or maintenance, petroleum product testing and field evaluation or related work.**
- **Age range . . . 22-32.**

Choice positions open in Cleveland, Toledo and Lima, Ohio.

Write, giving a complete resume of your education, experience and personal data to:

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There's a bright future waiting for the right men with

THE STANDARD OIL COMPANY (OHIO)

OPPORTUNITY

Supervisory research opening in Lion Oil, A Division of Monsanto Chemical Company for qualified person with at least 5 years experience in the formulation of petroleum specialties. Refining experience desirable but not essential. Location in El Dorado, Arkansas. Integrated refinery operations of moderate size. Real opportunity for advancement.

Address replies to:

E. R. COLEY
Technical Recruitment Coordinator
Lion Oil Company, A Division of
Monsanto Chemical Company
El Dorado, Arkansas

COLOMBIA, SOUTH AMERICA

Pipeline subsidiary of a major oil company operating in Colombia, South America has immediate openings for—

Engineering Department Manager—Must have a degree in Engineering plus 10 years pipeline engineering experience.

Senior Engineer—Must have a degree in Engineering plus 5 years pipeline engineering experience.

Electrical Supervisor—Must have broad experience in the installation and maintenance of pipeline engineering experience. Must also be familiar with the installation, repair and maintenance of AM & FM radio equipment.

These positions offer attractive salaries and bonuses, plus liberal benefit plans. Family can accompany employee. Desired age range 28 through 40. Qualified candidates are invited to submit full details of their education and experience to

Box J-755, The Oil and Gas Journal,
Tulsa, Oklahoma.

Please include your phone number so that an interview can be arranged. Interviews will be held in Houston, October 13, and Shreveport, October 16.

Graduate Petroleum Engineers with 2 years or more experience wanted by the Production Department of a major oil company. Openings available in Rocky Mountain and Mid-Continent areas. In first reply please give resume of experience and date available.

Box J-753, The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

PROCESSING ENGINEER: Outstanding opportunity for qualified man to assume processing engineering of moderate size complete refinery. Must have proven supervisory ability and experience with modern processing, organization and economics necessary. Preferred age 35-45. Company is stable and aggressive with unusually good prospects. Location in developing area with agreeable living conditions. Salary and other terms of employment offer a highly profitable career to right man. Must have college education and at least ten years' experience in latest type refining units. All replies will be held confidential and no obligation will be incurred by applicant. For full particulars write to Box J-763, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

Experienced graduate engineers for immediate openings in Saudi Arabia and New York City. For engineering work in development, production, drilling, process, and oil and gas engineering on primary and secondary recovery problems

RESERVOIR FLUID ANALYST

With degree in Physical Chemistry or Chemical Engineering plus 5 years' petroleum production engineering experience which should include 2 years' study of reservoir fluid behavior.

Salaries commensurate with training and experience. Write outlining personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 116

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE
NEW YORK 22, N. Y.

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FOR SALE, my producing Oil properties and producing royalty interests. Average income 1956 above $550. per month. Carries $15,000. tax write off for this year. Asking $45,000. Box J-764, The Oil and Gas Journal, Tulsa, Oklahoma.

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PRODUCTION WANTED

WANT TO BUY—Oil Properties, settled or semi-settled production. 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building Tulsa, Oklahoma.

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Mail: Apartado 3963
N. VanMiddlesworth
Phone: 54 48 02

SITUATIONS WANTED

PETROLEUM PRODUCTION ENGINEER extensive experience, both domestic and South America, desires responsible position with expanding Venezuelan operation. Box J-732, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: Masters degree, 29, 4½ years diversified experience, Oklahoma and Williston Basin. Presently Employed. Prefer association with Independent. Box J-737, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE CHEMICAL ENGINEER: With refinery, natural gas, economics and transmission experience desires challenging position. Box J-744, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 15 years with major oil company including positions of production superintendent and division engineer, desires engineering or staff work with aggressive organization. Box J-731, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: B.A., M.A., 4½ years experience, 33, married, desires position in Central or South America. Box J-758, The Oil and Gas Journal, Tulsa, Oklahoma.

CERTIFIED Public Accountant-Controller: Offers 20 years experience development and production of oil & gas properties, plant operations. Heavy tax, finance and public accounting work. Box J-761, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMIC Reflection Interpretation Specialist desires change, better pay. Age 39, B.S. Geology, good Spanish, married status. Ten years Venezuela, four years U. S. and three years Mexico. Twelve years supervisory capacity with seismic contractors. Wants position Venezuela or elsewhere in Latin America as oil company geophysicist, or division manager or chief geophysicist of seismic contracting firm. Box J-756, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTORNEY thoroughly experienced in oil law, drafting oil instruments, Texas title examinations, oil management consultation, trial of oil cases. 38, Texas honor graduate, highest legal rating. Moderate experience in leasing and land work. Reliable, personable, hard worker. Seeks responsible position with future in oil industry. Box J-757, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY MANAGER or Superintendent: For complete refinery operations, also to lubricants, oils, waxes, asphalts, seeks management operations position. Experienced Chemical Engineer, in refinery processings; degree, registered, Economics, good leadership, foreign or domestic. Top references. Box J-762, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOPHYSICIST available for special assignments. 25 years varied foreign and domestic experience. Leaving top geophysical post in large oil company at age 50 to devote time to independent interests. Would consider short term special assignments any part of world. Available Jan. 1, 1957. Box J-759, The Oil and Gas Journal, Tulsa, Oklahoma.

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MORE LOGS ARE FILED in Kraftbilt Strip Log Cabinets than all others combined. Loaded drawers glide smoothly on roller bearings. Three drawers per section, add sections as needed. Built to last a lifetime; Send for new Catalog 1156-B. Ross-Martin Co., P. O. Box 800-A, Tulsa 1, Okla.

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CONTRACTOR WANTED to drill 4 wells near Canadian Border to 4,750 ft. First 3,500 soft shale. Cable tools making 125 ft. hole per day. Terrific gas seepages of 99½% Methane. Will give liberal interest in 10,000 acres as part of drill costs. Urgent. Box 22, Emmaus, Pa.

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SACRIFICE SALE: Water flood equipment, new with 6 wells, tanks, pumps, lines, etc., and 800 acres lease all for $11,500. Near Chanute, Kansas. (Owner) P. O. Box 2, Chanute, Ph. 1215. 1st. come, 1st. served.

CONTACT A. L. BOWLES, Box 947, Ada, Okla., for attractive drilling deal in Seminole Co., Okla., or will drill well selling ¼ to ½ interest.

LEASE FOR SALE, 729 acres along the northeast border Utah, south of Rangely Field, excellent oil and gas possibilities. Box J-735, The Oil and Gas Journal, Tulsa, Oklahoma.

North Chaves County, N. M.

One field recommended already important discovery. Other major area to drill. Lease or Royalty interests at low cost in either field offer great potential value. Data on request.

W. J. PETERMAN, Geologist
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Portales New Mexico

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HAVE CAPITAL available to develop oil properties for participating interest. Box J-512, The Oil and Gas Journal, Tulsa, Oklahoma.

ESTABLISHED INDEPENDENT oil firm desires acreage within known geological structures. Straight leases or drilling deals considered. Submit full information to Box J-752, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL CONTACTS, Underwriters Brokers, Private Finders of Capital reached No shopping. Confidential. FREE ENTERPRISE ASSOCIATES 817—51st St., Brooklyn, N. Y.

$50,000.00 TO $100,000.00 WANTED: developing oil and gas field, producing best system known, patented, joint manager or royalty. STODDARD OIL, 1917 Stevens, Minneapolis 3, Minnesota.

WANT YOU to help me drill for Oil on 80 acres between two pools noted for their big wells. My Map and printed discussion will convince you that this offers a good chance for big production. ¾ interest $4800.00, ½ interest $3200.00, ¼ interest $1600.00, ⅛ interest $800.00, 1/16 interest $400.00 and 1/32 interest $200.00. Write O. A. Sewell, Box 103, Coweta, Oklahoma.

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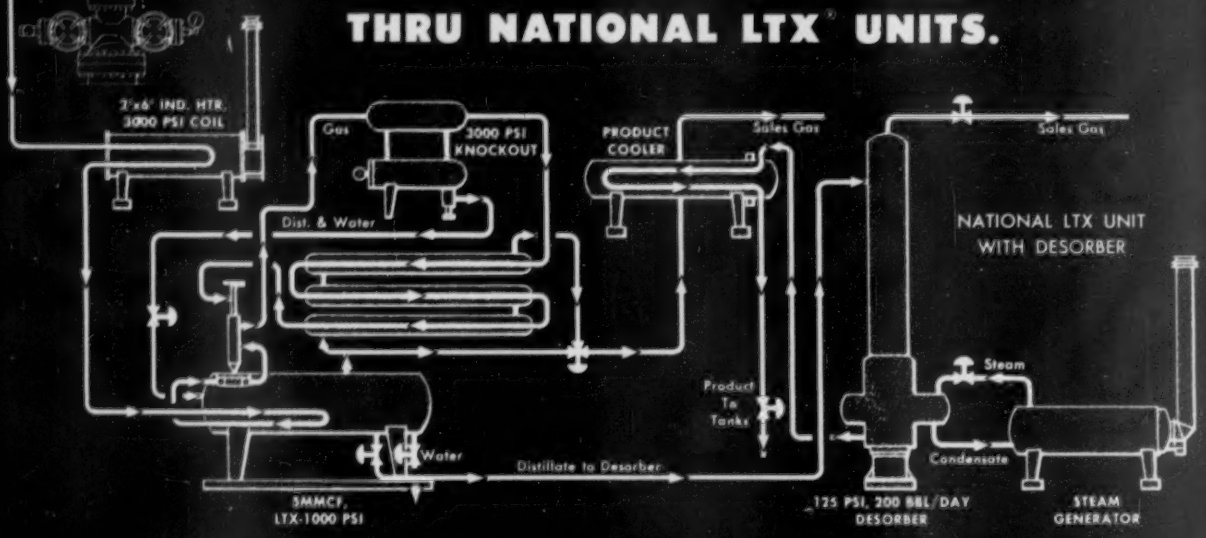

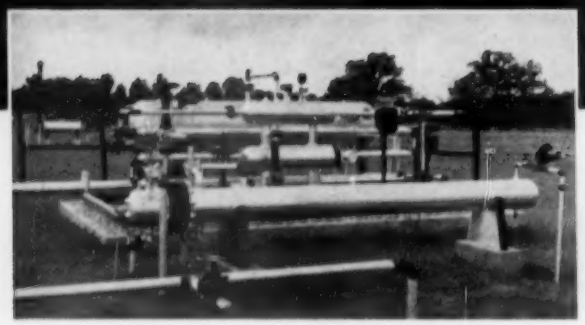

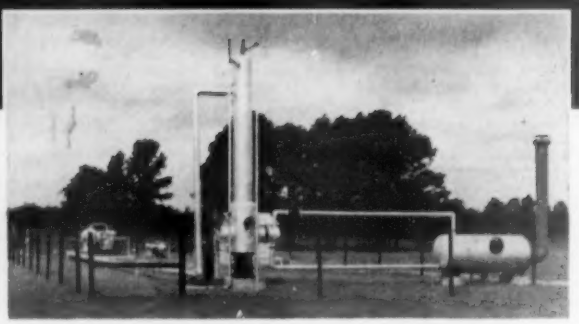

Installation of a National LTX Unit with desorber on this gas distillate well near Shreveport, Louisiana, INCREASED the recovery 14 barrels of stock tank liquid per MMCF of sales gas produced.* The well originally tested 70 barrels per MMCF with conventional separation equipment and increased to 84 barrels per MMCF of sales gas produced after the installation of LTX equipment. The LTX unit operates at approximately 300 psi and 5°F. Flowing pressure is approximately 2500 psi.

To receive maximum recovery from your lease, contact a National Tank Company representative in your area. You will find him nearby with "know how" and production equipment ready to serve your producing needs.

**For a more finite economic evaluation, the differences in recovery should be based on the unit of well effluent. This is not data that can easily be observed in the field for it requires calculations based on the wellstream hydrocarbon composition. Such determinations are often valuable.*

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NATIONAL TANK® COMPANY

TULSA, OKLAHOMA

	SERVICE	WHAT IT CONTAINS	FOR THESE WELLS	ADDITIONAL DESCRIPTION
OIL BASE	**PETROJEL**	Thickened crude, kerosene, or diesel fuel. Sand.	Oil or gas.	Primarily for use in formations with low acid solubility. Friction loss is lower than that of refined frac oils. Controlled fluid loss. Can be used at temperatures up to 200°F.
OIL BASE	**PETROFRAC**	Thickened crude, diesel fuel, or distillate. Sand.	Oil or gas.	Especially useful for treating wells with low bottomhole pressure. Use of high-gravity crudes makes it possible to fracture gas wells where heavier oil mixtures might be undesirable.
OIL BASE	**SANDFRAC**	Crude or refined oil. Sand.	Oil or gas.	For all types of formations—particularly suited to those of low acid solubility. Low fluid loss. Demulsifying agents may be added.
ACID BASE	**ACID PETROFRAC**	Acid-in-oil emulsion—using crude, kerosene, distillate, or diesel fuel. Acid is 90-95% of total volume. Sand.	Oil or gas.	Primarily for use in acid-soluble formations. Silicate control; retarded acid action; controlled fluid loss. Acid concentration can be varied from 1 to 15%.
ACID BASE	**FRAC ACID**	Thickened acid. Sand.	Oil, gas or water.	Primarily for use in acid-soluble formations where fracturing and acidizing are both desirable.
ACID BASE	**STRATAFRAC**	Acid-kerosene emulsion. Sand.	Oil or gas.	Primarily for use in acid-soluble formations. Acid concentration can be varied.
WATER BASE	**RIVERFRAC**	Fresh or salt water. With or without sand.	Oil, gas; water injection, disposal and supply.	For all types of formations. The use of water practically eliminates the fire hazard.
WATER BASE	**WATERFRAC**	Thickened fresh or salt water. Sand.	Oil, gas; water injection, disposal or supply.	Primarily for use in formations in which the use of oil-base treating materials might be undesirable or detrimental.

8 basic ways Dowell fractures wells

each treatment is selected and tailored to fit your well

Widest variety of fracturing services and materials in the oil industry

F.L.A.—Added to the treating fluid, this easy-to-use powder substantially lowers the fluid-loss characteristics.

FIXAFRAC—A Dowell service that temporarily seals initial fractures, or permeability already present, to permit a concentrated fracturing or acidizing attack on other sections of the pay formation.

MUD ACID—A Dowell acid that dissolves clay minerals and destroys the swelling properties of bentonitic material. As a spearhead, it increases treating effectiveness by cleaning formation face.

ACID INHIBITORS—Dowell acid inhibitors provide maximum protection to metal up to 350°F., yet allow full treatment effectiveness.

ADDITION AGENTS — Dowell engineers use a wide variety of addition agents in tailoring fracturing treatments to fit your wells. These agents control swelling of clay minerals and other silicates, lower surface tension, minimize formation of emulsions, speed up or retard reaction rate of acids with dolomites, etc.

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In the field, in treatment after treatment, this rugged Dowell pumper has proved its dependablity in oil and gas wells.

For more information, or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. J-11.

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